ISIS

International Review devoted to the History
:: of Science and Civilization ::
Quarterly Organ of the History of Science Society and of the International Committee of the History of Science

SUMMARY
of No 43 (Vol. XIV, 1)
276 p., 10 pl., 8 figs.

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Council Meeting of the History of Science Society

A council meeting was held on Monday, Dec. 30 at the Hope Valley Country Club, Durham, North Carolina, at 4 p.m. with the following members present: Drs. CREW, TYLER, CAJORI, WELCH, SIMONS, MAYER, invited former and new members, namely, Dr. KARPINSKI, Dr. SHRYOCK, Dr. D'IRSAY and the Secretary. Considerable business was transacted, namely, the reading of the various reports from the President, Secretary-Treasurer, Editor, and Committees. At 6 p.m. the members of the Council and invited members of the Society sat down to a most enjoyable dinner prepared in Southern style, and with rare judgment on the part of Dr. RICHARD H. SHRYOCK of Duke University.

The Officers for the year 1930 were elected as follows:

President. Dr. HENRY CREW, Northwestern University, Evanston, Ill.

Vice-President. Dr. WILLIAM H. WELCH, Institute of History of Medicine, Baltimore, Md.

Dr. BERTHOLD LAUFER, Field Museum, Chicago, Ill.

Members of the Council.

Dr. VICTOR ROBINSON, *Medical Life*, New York City.

Dr. HENRY G. GALE, Dean, University of Chicago.

Dr. RICHARD H. SHRYOCK, Dept. of History, Duke University.

Dr. ALFRED C. LANE, Consultant, Library of Congress.

Mr. GEORGE E. ROBERTS, National City Bank, New York City.

Dr. MAYER and Mr. BRASCH were reelected Recording Secretary, and Treasurer-Corresponding Secretary respectively. The meeting adjourned at 8.00 o'clock in order that the members could attend the general meeting of the American Historical Association to hear the Presidential address of Dr. JAMES H. ROBINSON.

F. E. B.

Joint Meeting of the History of Science Society with the American Historical Association (Durham and Chapel Hill, North Carolina, January 1, 1930).

A.M. 10.00. Lecture Hall, Science Building.

Chairman: LYNN THORNDIKE, Columbia University.

A phase of the History of Mathematics in the United States.
LAO G. SIMONS, Hunter College.

The popularization of science in the revolutionary era.
EVARTS B. GREENE, Columbia University.

A century of American geodesy.
FLORIAN CAJORI, University of California.

Discussion, led by:
L. C. KARPINSKI, University of Michigan.

P.M. 12.30. Luncheon conference on the History of Science. Union, Left dining room.
(Courtesy of Duke University)

Chairman: H. W. TYLER, Massachusetts Institute of Technology.

Medical practice in the ante-bellum South.
RICHARD H. SHRYOCK, Duke University.

P.M. 2.00 Meeting of the Council of the History of Science Society. Duke University, North Campus.

Aristotle and Phyllis

The British Museum acquired recently (at Christie's, February 11, 1929) three beautiful drawings of the early sixteenth century which were formerly in the collection of Sir THOMAS LAWRENCE. One of them, a pen drawing by an unknown artist of the Antwerp school, represents the story of ARISTOTLE and PHYLLIS. It gives me a good pretext for speaking of that story, which first drew my attention many years ago. As I was pursuing my studies on the Aristotelian tradition, I could not help thinking of PHYLLIS from time to time, and gathering notes on her subject. It will be seen that an account of that episode, far from being futile, is a real contribution to the understanding of popular Aristotelianism in western Europe in the thirteenth century and later.

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Let us hear the story first. While ALEXANDER was conquering Asia, he became so much infatuated with PHYLLIS, an Indian damsel whom he had taken to himself as a wife, that he neglected the affairs of the state. The nobles sent ARISTOTLE to remonstrate with him, who did so to such good purpose that the Great King turned his mind once more to business. Of course this did not please the queen, and having found that ARISTOTLE was at the bottom of her husband's coldness, she resolved to revenge herself. She attracted his attention, made advances to him, and in no time the philosopher was head over heels in love. As he was pressing her to requite his love, she said he must prove it first, by allowing her to ride upon his back. ARISTOTLE was ready to grant her anything and at last consented. In the meanwhile she had warned her husband so that he might watch the performance, and placing a saddle on ARISTOTLE's back, a bit in his mouth, etc., she rode upon him, he walking upon all fours. ALEXANDER then summoned

him and demanded that he explain how his conduct could be so at variance with his advice. Whereupon the philosopher replied : « If a woman can make such a fool of a man of my age and wisdom, how much more dangerous must she not be for younger ones? I added an example to my precept, it is your privilege to benefit by both. »

The main motive of that story — a woman beguiling a wise man and persuading him to let her ride upon his back — is very old. It can be found in early Indian collections, the series of didactic fables called *Pañcatantra* (1) and the Buddhist stories or *Jâtaka*, and also among other Buddhist stories preserved in the Kanjur.

It can be found also in Arabic literature, at least twice, first in the *Kitâb al-maḥâsin wal-aḍdâd* (Book of good works and their opposites) by AL-JÂḤIẒ (d. 868; see my *Introduction*, vol. 1, 597), then in the miscellany of oriental tales published by CARDONNE in 1770. The third tale of CARDONNE's collection, The vizir saddled and bridled, is almost exactly the same tale as that of ARISTOTLE and PHYLLIS, except that the main characters are a sultan, his wife and his vizir. Unfortunately we do not know its origin. Assuming it to be late, the existence of the earlier version by AL-JÂḤIẒ shows that the story had continued to grow in Muslim circles.

It is impossible to tell how this eastern story reached the west. The fact that it was not included among the Indian lore translated into Arabic under the title *Kalîla wa-Dimna*, excluded it from the literary tradition which explains so simply the transmission of other tales. We do not find it in *Barlaam and Ioasaph*, nor in the *Disciplina clericalis* of PEDRO ALFONSO, nor in the *Directorium vitæ humanæ* of JOHN of CAPUA. JAMES of VITRY may have been the intermediary. He had lived in the east, being bishop of Acre and patriarch of Jerusalem; moreover the story is ascribed to him by JOHN HEROLT. However it is not preserved in his *Sermones vulgares (Speculum exemplorum)*. Besides JAMES died only in 1240, and by that time it is probable that the story of ARISTOTLE

(1) The heroes of the story as told in the *Pañcatantra* are King NANDA, his wife (unnamed), and his minister VARARUCI. Now there were nine kings called NANDA who flourished between 413 and 322; and VARARUCI, a famous grammarian, was actually minister to NANDA. ALEXANDER's expedition into India took place in 327-25. Hence the Indian story refers to a time just anterior to, or contemporary with, ALEXANDER's expedition.

was already developed in the west as we shall see presently. The transmission by JAMES is plausible but it would be almost too late to be explanatory.

However the lack of literary links need not disturb us. Folk tales were transmitted primarily by word of mouth; their literary forms must not be regarded as essential, but rather as casual emergences. The distribution and development of tales was very much like the diffusion of gossip. Publication was an accidental by-product, which occurred only when the tale fell upon the ears of a literary man, or of a person afflicted with the *cacoëthes scribendi*. Even in our days of immense and ubiquitous printing, many are the stories which never get into print. So much so that it is still possible for folklorists to make discoveries by listening to the tales and songs of unsophisticated people.

To return to the tale which we are now discussing, whichever be its origin — and I have no doubt that it came from the East — the Aristotelian form was almost certainly an invention of western Europe. Let me repeat that there is no mention whatever of ARISTOTLE in the Arabic versions. On the other hand, the old tale was applied to ARISTOTLE in a French fabliau composed by the Norman trouvère, HENRI D'ANDELI, in the first half of the thirteenth century. « Li lais d'ARISTOTE », as this fabliau is entitled, is a poem of 579 lines, wherein the heroes of the story are « the king of Greece, ALEXANDER », ARISTOTLE, and the Indian damsel, who is unnamed. A similar story, « ARISTOTELES und FILLIS » was told in high German at about the same time. It is not possible to say which was the earlier, the French or the German story, but the name PHYLLIS appears for the first time in the German text. I may add here, incidentally, that in other versions of the same tale, the damsel is called CAMPASPE, and spoken of as the queen mother's maid, or a courtesan, etc. These details being irrelevant to my purpose, I shall not investigate them, and shall always call the damsel PHYLLIS (2), if only to help drive out the other name, which is not half as nice.

The point which interests us is this : How shall we account for the application of the old tale to ARISTOTLE in the first half

(2) The spelling PHYLLIS is the correct one assuming the name to be Greek. The name does exist in Greek.

of the thirteenth century? Some influence to that effect may have been exerted by the *Sirr al-asrâr*, of which a Latin version had already been made by JOHN OF SEVILLE about the middle of the twelfth century. The *Secreta secretorum* relates that the queen of India sent to ALEXANDER a beautiful maiden who had been fed with the venom of serpents, hoping that she would contaminate the king and cause his death, but the wise ARISTOTLE warned him in time. Of course it is well known that folktales affect one another in various ways, that motives and patterns are easily exchanged, etc. One might thus assume that ARISTOTLE was introduced into the tale of the vizir saddled and bridled because of some confusion or suggestion due to the other tale.

However that seems a little far fetched, and I think that the invention of the ARISTOTLE story can be explained in a simpler way. The point of the original story was to illustrate the dangerous power of woman. The wiser the man beguiled by her coquettish wiles, the stronger the point. Now during the earlier part of the Middle Ages, ARISTOTLE had been known in western Europe almost exclusively as a great teacher of logic, but by the beginning of the thirteenth century he was finally coming into his own as the most learned and wisest man of all times, the very personification of all knowledge, the Master by excellence. He had been the tutor of a great king, able to advise him almost in the same way as the vizir advised the sultan? Was not the transfer from vizir to philosopher natural enough? Moreover an additional point was thus being gained into the bargain. For after all, ARISTOTLE had been a pagan. His shameful failure illustrated not only the malicious power of women and the triumph of love, but the vanity of philosophy, especially of that philosophy which was as yet unredeemed by Christian grace.

No wonder that the story, thus transformed into a Christian sermon against lay wisdom, was immensely popular in Christendom. Our witnesses of that popular success are not so much the writings, few in number, as the sculptures decorating the doorways of cathedrals, the capitals of columns and pilasters, the misericords of stalls, not to speak of movable objects, such as aquæmanalia, ivory caskets, etc. But I am going perhaps a little too fast, for there is no absolute proof that the popular motive — the wise man beridden by a gay damsel — referred always

to ARISTOTLE. It had its place in the church anyhow, as an « exemplum » showing the danger of woman, (this had become a regular obsession to the mediæval clerks). (3) In fact it was often treated as a companion piece to other stories of the same kind : ADAM and EVE, SAMSON and DELILAH, DAVID and BATHSHEBA, HERCULES and OMPHALE, VIRGIL hanging mid-air in a basket.

This doubt is inspired in me by the strange circumstance that the Aristotelian tale did not appear in Latin until the beginning of the fifteenth century. The story itself may be found in an earlier text, the *Scala coeli*, a collection of exempla collected in the first half of the fourteenth century by the French Dominican, JOHN GOBI JUNIOR (fl. c. 1326), but without reference to ARISTOTLE, indeed without any name except that of VALERIUS (MAXIMUS) quoted as the authority. The first Latin text containing the story as applied to ARISTOTLE is found in the *Promptuarium exemplorum*, composed by another Dominican, the German JOHN HEROLT, called « Discipulus » (d. 1418), who ascribed it to JAMES OF VITRY. The fact that these compilers of exempla, JOHN GOBI JUNIOR and JOHN HEROLD, were both Dominicans is not surprising, for it is they, the Friars Preachers, who needed those « exempla » for their sermons. These sermons were probably the main vehicles of this particular story in western Christendom ; it is also probable that the Preachers applied the story to the great master of vorldly knowledge, ARISTOTLE, adding a wealth of details which made it more telling, but we cannot be sure.

The Latin story as related by JOHN HEROLD is so quaint and so brief, that I reproduce it verbatim.

ARISTOTILES, cum doceret ALEXANDRUM ut se contineret ab accessu frequenti uxoris suae, quae erat pulchra valde, ne animum suum a communi providentia impediret, et ALEXANDER ei acquiesceret, hoc advertens regina et dolens, coepit ARISTOTELEM trahere ad amorem suum, quia multociens sola transibat cum pedibus nudis et dissoluto crine, ut eum alliceret. Tandem allectus coepit eam sollicitare carnaliter, quae ait, « Hoc omnino non faciam, nisi videio signa amoris, ne me tentes : ergo veni ad meam cameram, reptando manibus et pedibus, sicut equus me portando, tunc scio quod non illudes mihi. » Cui conditioni cum consensisset, illa intimavit hoc ALEXANDRO; qui expectans apprehendit eum reginam portantem. Quem cum vellet occidere, ait ARISTOTELES sic se excusando, « Si sic accidit seni sapientissimo, ut a muliere deciperer, potes videre quod bene

(3) EMILE MÂLE : L'art religieux du XII[e] siècle en France (Paris, 1922). Reviewed in *Isis*, 6, 52-56.

docueram te, quid accidere potest tibi juveni. » Quod audiens rex, ei pepercit, et in doctrina ejus profecit.

One more argument in favor of the western application of the tale to ARISTOTLE at a relatively late period, is the fact that the tale is not included in the romance of ALEXANDER nor in the mediæval biographies of ARISTOTLE. I would not assert that it was never included in the Alexandrian cycle, because there are innumerable texts in almost every language, but I do not know examples of its occurrence before the thirteenth century. In other words the tale of ARISTOTLE and PHYLLIS is an independent development. By the way, similar remarks apply to the story of VIRGIL, which is often associated with that of ARISTOTLE and PHYLLIS, and may have originated in the same time and place, if not in the same mind. According to that story, VIRGIL had been given an assignation by a Roman lady who lived at the top of a tower. He was to be lifted up to her room in a basket, but she left him dangling half-way throughout the night. Next day, the whole town came to watch the famous magician, who knew everything except the extent of feminine wiles. That story is not generally mentioned in the mediæval accounts of VIRGIL. e. g., VINCENT OF BEAUVAIS does not speak of it. Its purpose was the same as that of the ARISTOTLE story, and VIRGIL had been selected for the same reason as the Greek philosopher, because he was an ideal personification of lay wisdom.

I shall not deal with the history of the tale of ARISTOTLE and PHYLLIS after the fifteenth century, but one curious little fact deserves to be quoted as it illustrates remarkably well the obscure continuation of a popular theme and its unexpected emergence. A little book published in Paris, an IX (1801) describes a drawing room game, called « Le cheval d'ARISTOTE », wherein a man is obliged, as a forfeit, to walk around the room upon all fours, carrying one of the ladies upon his back. (4)

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(4) Le petit savant de société, ouvrage dédié à la jeunesse des deux sexes, contenant la manière de jouer tous les jeux innocents dont on s'amuse en société, et les pénitences qui s'y ordonnent... Recueil extrait des manuscrits de M. ENFANTIN, corrigé et augmenté par M. DE BELAIR, 2e édition. Paris, CAILLOT, Quoted by A. GASTÉ : Un chapiteau de l'église Saint-Pierre (Caen, 1887, p. 47, pl. 2), who states that the first edition appeared in 1801.

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Iconography.

I have no intention of making a complete iconographic study of the subject, as this would carry us too far away from our own field. But as the popularity of that story is proved chiefly by iconographical means, I wish to mention a sufficient number of good examples to give the reader an idea of the kind of documents he may expect to find.

Let us take *Ivories* first. (1) The story is represented upon an ivory leaf forming the cover of tablets used for writing purposes. This object of the first half of the thirteenth century was for some time in the cabinet of St. Germain-des-Prés. (The other cover told VIRGIL's story.) BERNARD DE MONTFAUCON : L'antiquité expliquée par les monuments (vol. 3, second part, p. 356, pl. 194, devoted to writing tools; folio, Paris, 1722).

(2) Casket with subjects from knightly life and romance, in the British Museum. Front part. French, fourteenth century. O. M. DALTON : Catalogue of the ivory carvings of the Christian era in the British Museum (London, 1909, no. 368, p. 125-27, pl. 86).

More examples would in all probability be found in the catalogues of ivories of other museums and in special treatises.

Sculptures. (3) The earliest example I know is a capital in in St. Peter's church, Caen (Normandy). It dates from the fourteenth century. Abbé GERVAIS DE LA RUE : Essais historiques sur la ville de Caen (2 vols., Caen, 1820; vol. 1, 97, with poor reproduction). ARMAND GASTÉ : Un chapiteau de l'église Saint-Pierre de Caen (54 p., Caen, 1887, 3 pl.; contains a reproduction of that capital and of five other examples).

(4) Another example of the same time, and far better, is to be seen on the front of St. John's church, the cathedral of Lyon. I reproduce (fig. 1) a line engraving of it after F. DE GUILHERMY : Fabliaux représentés dans les églises. Lai d'ARISTOTE. (*Revue générale de l'architecture et des travaux publics*, vol. 1, 385-96, folio, Paris, 1840); ARISTOTE et VIRGILE (*Annales archéologiques*, vol. 6, 145-57, 1847). Photograph of same monument in EMILE MÂLE : L'art religieux du XIII^{e} siècle en France (4th ed., Paris, 1919, p. 361).

Selected drawings and engravings. (5) The Master of the Amsterdam Cabinet. Dutch or Rhenish-Suabian engraver who flourished in the last quarter of the fifteenth century; perhaps the greatest engraver of that century. The very charming engraving reproduced in our figure 2 is preserved in the museums of Amsterdam, Coburg, Oxford, and Vienna. (15.5 cm.). MAX LEHRS: The master

Fig. 1. Cathedral of Lyon, fourteenth century.

of the Amsterdam cabinet (International chalcographic society, 1893-94; no. 54).

(6) Master M. Z. (often called MARTIN or MATTHEW ZATZINGER though on little foundation). Bavarian engraver who flourished c. 1500. See our fig. 3, reproduced after the example kept in the Fogg Museum (13 × 18 cm.). WILLIAM HUGHES WILLSHIRE : Catalogue of early prints in the British Museum. German and Flemish schools (vol. 2, 402, 1883). A. M. HIND : History of engraving and etching (London, 1923, p. 36).

(7) Pen drawing by an unknown artist of the Antwerp school, c. 1520, recently acquired by the British Museum (see beginning of this paper). Reproduced in our figure 4 (27.5 × 19 cm.).

Published for the Vasari Society (part 10, no. 8, autumn, 1929), by the Oxford University Press.

(8) LUCAS VAN LEYDEN (1494-1533). Woodcut of very large size (41 × 29 cm.) discovered by CAMPBELL DODGSON in the Paris cabinet and described by him : ARISTOTELES und PHYLLIS, ein unbeschriebener Holzschnitt des LUCAS VAN LEYDEN (*Jahrbuch der K. preussischen Kunstsammlungen*, vol. 18, 184-86, 1 pl., Berlin, 1897). Our figure 5 is reproduced from a full size facsimile kindly given to us by Mr. DODGSON.

The subject was a favorite with Renaissance artists. For example, it was engraved on copper by WENZEL VON OLMÜTZ and by the Master B. R. For these two early engravers, see MAX LEHRS : Geschichte und kritischer Katalog des deutschen, niederländischen und französischen Kupferstichs im XV. Jahrhundert (vol. 6. p. 243, 308, Vienna, 1927; the second is reproduced in album 6). It was dealt with also by HANS BURGKMAIR (c. 1473-1531), and by HANS BALDUNG GRIEN (1475/80-1545). However the last named created an entirely different picture (c. 1515) by representing PHYLLIS riding on ARISTOTLE's back, both naked. This may be allowed of course as an artistic fancy (though we wish he had found a better model for PHYLLIS), but may be disregarded in an iconographic study, for it is entirely at variance with the tradition, and by introducing new implications, misses the main point of the story.

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Text.

Hindu sources — THEODOR BENFEY : Pantschatantra. Fünf Bücher indischer Fabeln, Märchen und Erzählungen (Leipzig, 1859, vol. 2, 306-307). A. SCHIEFNER : Mahâkâtjâjana und König Tshanda-Pradjota. Ein Cyclus buddhistischer Erzählungen (*Mémoires de l'Académie des sciences de St. Pétersbourg*, tome 22, no. 7, 75 p., 1875). E. B. COWELL : The Jâtaka or stories of the BUDDHA's former births, translated from the Pâli by various hands (vol. 2, Cambridge, 1895).

Arabic sources. — German translation of AL-JÂḤIẒ's story by VICTOR VON ROSEN, in appendix to SCHIEFNER's memoir (1875, 66-67). DENIS DOMINIQUE CARDONNE : Mélanges de littérature

Fig. 2. Master of the Amsterdam Cabinet.
Last quarter of fifteenth century.

Fig. 3. Martin Zatzinger. c. 1500-1509.

Fig. 4. Pen drawing, school of Antwerp, c. 1520.

Fig. 5. Lucas van Leyden, 1494-1533.

orientale, traduits de différents manuscrits turcs, arabes et persans de la Bibliothèque du Roi (Paris, 1770). I have used a later edition (La Haye, 1788, 10-19). English translation, A miscellany of eastern learning (2 vols., London, 1771; vol. 1, 14-18).

French text. — Lai d'ARISTOTE, first edited by ETIENNE BARBAZAN : Fabliaux et contes (vol. 1, Paris, 1756). Often reprinted. Critical edition by ALEXANDRE HÉRON : Oeuvres de HENRI D'ANDELI (Rouen, 1880). Separate edition of the Lai d'ARISTOTE by the same (46 p., Rouen, 1901).

German text. — First edition by CH. H. MYLLER : Sammlung deutscher Gedichte aus dem XII., XIII., und XIV. Jahrhundert (vol. 3, not seen; vols. 1-2 appeared in Berlin, 1784-85). F. H. VON DER HAGEN : Gesammtabenteuer (vol. 1, 19-35, 1850; see also p. lxxv-lxxxii).

Latin texts. — There are many incunabula of the *Scala cœli* of JOANNES GOBII (or GOBIUS JUNIOR). Lübeck, 1476; Ulm, 1480; Strassburg, 1483; Louvain, 1485; etc.

The text of JOHN HEROLT reproduced above, was edited by THOMAS WRIGHT : A selection of Latin stories (Percy Society, vol. 8, London, 1842, 74). There are many incunabula of his *Sermones discipuli de tempore et de sanctis cum promptuario exemplorum et de miraculis Virginis.* Cologne, s. a.; Strassburg, 1483; Speier, 1483; Lyon, 1483; Strassburg, 1484; Basel, 1486; Lyon, 1489; Strassburg, 1492, 1495; Paris, 1500.

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Criticism.

Iconographical references have been quoted for the reader's convenience after the mention of the monument with which they dealt.

As observed above, most of the immense literature on the Alexandrian romance is irrelevant. However some additional information may be found in it, for which see WILHELM HERTZ : ARISTOTELES in den Alexanderdichtungen des Mittelalters (*Abhandlungen der philos. Klasse der bayerischen Akademie*, vol. 19, 103 p., München, 1891).

JOSEPH BÉDIER : Les fabliaux (Paris, 1893; 4th ed. revised, 1925, 204-12).

A. BORGELD : ARISTOTELES en PHYLLIS. Een bijdrage tot de vergelijkende litteratuurgeschiedenis (122 p., Groningen, 1902). FR. MOTH : Aristotelessagnet eller elskovs magt. Et bidrag til sammenlignende novelleforskning (271 p., Kristiania, 1916).

LOUIS GINZBERG : ARISTOTLE in Jewish legend (*Jewish encyclopedia*, vol. 2, 98-99, 1902). JOSEPH HELLER : ARISTOTELES (*Encyclopædia judaica*, vol. 3, 340, 1929). Both authors repeat the error that the story of ARISTOTLE and PHYLLIS is included in the *Disciplina clericalis*. Both state that the story was translated into Hebrew and exists in a MS. by JUDAH BEN SOLOMON HA-KOHEN (first half of the thirteenth century), referring to SPIRGATI's Catalogue (Nr. 76, 1900, p. 18). This catalogue being unavailable to me I applied to Dr. ALEXANDER MARX, who kindly answered (letter of Oct. 31, 1929). « The MS. described in SPIRGATI's catalogue 76, nr. 432, is a copy of JUDA B. SALOMO COHEN's Midrash haḥokma containing the first part, analytics and metaphysics. At the end of the description of the MS., which was written in 1428 at Bologna, there is a note « Am Schluss auch die Geschichte von ARISTOTELES m. der Frau d. ALEXANDER u.a.m. » I do not find any reference to this conlusion in STEINSCHNEIDER's full description of a MS. of this work in Catalogue Berlin II, p. 121-26, nor in his earlier discussions ot the work. I have a notion that I read the story quoted from another Hebrew text, but I am not able at the moment to put my hand on it. GEDALYA IBN YAHYA, in his Shalshelet ha-Cabbala, Venice, 1587, fol. 102, mentioned the story from a biographer of ARISTOTLE, that the latter was in love with a concubine of a friend and that he brought her a sacrifice as was done by the priests to the idols. »

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I have devoted so much space to this story because it throws some light upon the popular Aristotelianism of the thirteenth century and the clerical reaction against it. I have retold it partly in the spirit of those who told it before. The candid and ingenious clerk who had the idea seven hundred years ago of bringing an old story up-to-date and giving new zest to it by changing a Muslim vizir into a Greek philosopher, did not do so without a good purpose. He wanted to put his brethren on guard against

their greatest peril. This warning is just as timely to-day as it ever was. If the infallible Master failed as ignominiously, any excess of confidence in ourselves is mere foolishness. We must not feel too secure in our virtue, nor ever take our salvation for granted, for we are all the time surrounded by dangerous creatures.

Cambridge, Mass. GEORGE SARTON.
October 31, 1929.

I acknowledge gratefully the courtesies of Mr. CAMPBELL DODGSON, Curator of the Department of prints and drawings, British Museum, for permission to reproduce figs. 4 and 5; of Mr. A. E. POPHAM, honorary secretary of the Vasari Society, for fig. 4; of Prof. PAUL J. SACH, Director of the Fogg Museum, Harvard University, for figs. 2 and 3 and for information on the master M. Z.; of Prof. ALEXANDER MARX, of the Jewish Theological Seminary of America, for information on a Hebrew MS.

G. S.

El "Libro de Los Animales" de Jâḥiẓ

Este famoso polígrafo de Basora (siglo IX de J. C.) es más conocido como literato y filósofo, que como hombre de ciencia. (1) La universal curiosidad de su espíritu invita más bien a calificarlo de enciclopedista. En el catálogo numeroso de sus obras abundan las que tratan temas pertinentes a las ciencias físicas y naturales. JÂḤIẒ mismo, en el prólogo de su *Libro de los animales* (2), nos ha conservado los títulos de algunas de esas obras, suficientes por sí solos para sugerir la importancia de su contenido. He aquí una lista de las más interesantes para la historia de la mineralogía, química, botánica, etnología, antropología, técnica, sociología etc. : Libro de los hombres de pura raza y de los mestizos; de la superioridad de los negros o de los blancos; de los cereales, de la palmera, del olivo y de la vid; de las artes y del comercio; de las diferencias entre los hombres y las mujeres, y, en general, entre los machos y las hembras, es decir, en qué cosas aventajan éstas a aquéllos, y qué parte toman respectivamente en la generación y cuáles artes y profesiones son más acomodadas a la índole de las hembras; libro de los árabes y los clientes; libro de los árabes y los no árabes; libro de los ídolos, en el cual se estudia la afición de los indios al culto de Buda y la de los árabes anteislámicos a la idolatría; libro de los minerales, en que se estudian : las diferentes sustancias de la tierra y los varios géneros de metales (líquidos y sólidos, naturales y artificiales); cómo cambian de estado unos rápidamente y otros con lentitud; cómo determinados colores tiñen sin ser teñidos,

(1) Sobre su vida y obras cfr. SARTON, *Introduction to the history of science*, I, 586 y 597. Sobre sus ideas filosóficas y teológicas y el influjo que ejercieron en los orígines de la filosofía hispano-musulmana, cfr. ASIN, *Abenmasarra y su escuela* (Madrid, 1914), págs. 21 y 133-137.

(2) *Kitâb al-Ḥayawân* (edic. Cairo, 1323 hégira) tomo I, págs. 2-5.

mientras otros son teñidos y no tiñen, y otros tiñen y son teñidos; cómo debe resolverse el problema del elixir o piedra filosofal y el da la sutilización *(talṭîf)*; libro de las matemáticas etc. Aunque desgraciadamente no se conservan la mayoría de estos libros de JÂḤIẒ, sin embargo algunos temas interesantes, relativos a ellos, aparecen de vez en cuando a través de las páginas copiosas de su monumental *Libro de los animales* (3).

No es este libro un tratado sistemático y técnico de zoología, sino más bien un desordenado centón de datos científicos, mezclados con noticias folklóricas, poesías, cuentos y anecdotas, a propósito de los animales. El objeto principal que el autor se propuso fué, no tanto instruir, como amonestar al lector, poniendo ante sus ojos las maravillas del mundo animal, para que por ellas pudiese vislumbrar la providencia de Dios. En repetidos pasajes JÂḤIẒ insiste sobre este fín último de su libro, al cual subordina el método y plan de redacción. No escribe para los técnicos, sino para el gran público : por eso rehuye seguir un orden científico en la enumeración y tratado de las diferentes especies zoológicas y en cambio procura amenizar cada capítulo, insertando al principio cuentos y poesias (4).

Pero si el libro no es científico por su plan y método, lo es en alto grado por su materia. Ante todo, la información del autor deriva de excelentes fuentes. Como él mismo lo insinua en el prólogo (I, 6), puso a contribución para redactarlo los libros de los filósofos, los relatos y noticias de viajeros, marinos etc. y la observación o experiencia directa. La afición de JÂḤIẒ a los libros es famosa en el islam. Sobre las excelencias de todo libro, inserta en el prólogo de éste de los animales (I, 24-48) un interesante artículo, lleno de sugestiones muy atinadas : en él recoge las frases más célebres en elogio del libro y pondera la superioridad de la escritura, respecto de todos los otros medios de expresión de las ideas, incluso la viva voz, porque « verba volant et scripta manent » y no siempre es fácil encontrar maestros, pero sí libros, que son

(3) Consta de siete tomos o partes, con un total de 1089 págs. que se distribuyen así : I, 196; II, 135; III, 168; IV, 156; V, 175; VI, 175; VII, 84.

(4) He aquí los pasajes en que JÂḤIẒ expone el objeto, contenido, método y plan de su libro, defendiéndose de los criticos que lo censuraron, sin duda, al aparecer sus primeros ejemplares : *Ḥayawân*, I, 6, 19, 46; III, 2, IV, 69; V, 50; VI, 2, 75; VII, 2, 4.

monumentos más perennes que los palacios y alcázares. La mezquindad en la compra de libros y la virtud de la esplendidez son temas que también ocupan su atención, para elogiar ésta y vituperar aquélla. Entrando luego a fijar las cualidades más estimables en el libro, señala como la más preciada la claridad y, después, la concisión, pero sin extremarla. Entre los consejos que da al autor de un libro, resaltan estos por su discreción : « Escribe como si todos los hombres fuesen adversarios tuyos, entendidos en la materia y lectores atentos. » « No te entusiasmes de tu primera redacción. Revísala más tarde en frio. » La transmisión de la ciencia griega, india y persa al fondo cultural del islam refléjase también en alusiones breves, pero altamente sugestivas para la historia de las traducciones árabes de los libros de EUCLIDES, GALENO, ARISTÓTELES etc., del *Almagesto* y, en general, de las obras de lógica, medicina, matemáticas, astronomía, música, agricultura, química, mecánica, técnica (artes del mosaico, del vidrio y de la loza), marina etc., aunque desgraciadamente sin consignar puntualmente los títulos y autores (5). Y es que el objeto principal de estas alusiones es más bien documentar las normas que estima indispensables para el traductor. Consciente JÂḤIẒ de la superioridad científica de los pueblos no árabes, reconoce sin dificultad el legado que el islam recibió de la cultura clásica y confiesa que los conocimientos empíricos de los árabes en materia científica son insignificantes, comparados con el inmenso caudal que atesoran los libros griegos, persas e indios. De aquí, la necesidad de las traducciones, por cuyo medio el islam se hizo heredero universal de la ciencia de los pueblos antiguos. No se ocultan, sin embargo, a JÂḤIẒ las dificultades de una traducción fiel, exacta y técnica. El traductor, en efecto, debe poseer, en lo posible, un dominio de la ciencia particular, tratada por el libro que intente traducir, aproximadamente igual a la de su autor, porque las palabras no pueden interpretarse más que en función de las ideas, y cuando éstas son científicas, tienen un valor técnico que la lengua vulgar ignora. (6) Por otra parte, debe dominar perfectamente el traductor las dos lenguas : la del

(5) Cfr. *Ḥayawân*, I, 38, donde cita, como traductores al árabe de las obras de ARISTÓTELES, a los siguientes : IBN AL-BAṬRÎQ, IBN NÂ'IMA, ABÛ QURRA, IBN FIHR, IBN WAHÎLÎ, IBN AL-MUQAFA; y como traductor de PLATÓN a KHÂLID.

(6) Sobre las dificultades del tecnicismo científico cfr. I, 45 y III, 113.

original y la de la traducción; pero, como nota finamente JÂḤIẒ, este mismo dominio de ambas lenguas implica forzosamente el peligro de la confusión : el que habla dos lenguas, equivoca a menudo el léxico o el giro de la una con el de la otra. La precisión en el uso de los sinónimos es otra dificultad, casi insuperable para el traductor que busque la fidelidad y la exactitud. Añádense a todas éstas las dificultades nacidas de la grafía, pues las escrituras arcaicas, de una parte, y los caracteres extranjeros, de otra, y las grafías erróneas de los copistas, finalmente, son un semillero de equivocaciones inevitables. Si aun en las obras redactadas en la lengua materna son tan frecuentes — dice JÂḤIẒ — los errores de interpretación de un texto, nacidos de las erratas de copia en los manuscritos, que se perpetúan por culpa de copistas asalariados y negligentes, mucho más tiene que ocurrir esto con los libros traducidos.

No es muy explícito JÂḤIẒ respecto de las fuentes bibliográficas aprovechadas en su *Libro de los animales*. Algunas veces cita fuentes árabes, más literarias y filológicas que estrictamente zoológicas, sobre algún animal, el caballo por ejemplo (7); pero en cambio abundan en sus páginas las referencias al famoso *Libro de los animales*, de ARISTÓTELES, a quien casi siempre designa con la perífrasis de « el autor de la lógica ». (8) No es pues justa la censura que el BAGDÂDÎ lanza en su FARQ contra JÂḤIẒ, acusándole de haber plagiado en este libro a ARISTÓTELES y a algunos zoólogos árabes (9). También las obras médicas de GALENO son puestas a contribución para documentar puntos concretos, atinentes a enfermedades producidas por la picadura de algunos animales, al instinto de ciertas aves etc. (10). Finalmente, el libro de CALILA y DIMNA se cita también alguna vez, a propósito del águila y del elefante (11). Huelga decir que a cada paso aparecen textos del *Alcorán*, tradiciones de MAHOMA y, sobre todo, versos clásicos árabes, relativos a los animales, que son preciosos documentos folklóricos, para estudiar los conocimientos empíricos y las supersticiones zoológicas de los árabes anteislámicos.

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(7) *Ḥayawân*, VI, 150.
(8) *Ḥayawân*. V, 19; VI, 6, 90 y *passim*.
(9) *Kitâb al-Farq bayna al-firaq* (edic. Cairo, 1910) pág. 160-165.
(10) *Ḥayawân*, III, 113; IV, 43; VII, 10, 13.
(11) VI, 108; VII, 29.

A estas fuentes bibliográficas hay que añadir, como arriba insinuamos, las observaciones personales de JÂḤIẒ y las noticias por él recogidas en sus viajes. Un pasaje bien explícito nos documenta a este respecto, al hablar de las guaridas de ciertos animales. Dice así (VII, 15) : « A lo largo de mis excursiones por los desiertos y las tierras habitadas, he penetrado en lo más interior de las vastas y desiertas llanuras de la Península Arábiga, de la Anatolia, de la Siria, de la Mesopotamia y de otros países, y no sé que yo haya visto, en medio de los senderos ni de los caminos reales,.... cosa parecida; y eso que recorrí los senderos y examiné atentamente los lugares despoblados... » Por lo que toca a testimonios ajenos, a cada paso los invoca JÂḤIẒ, para confirmar o rectificar los datos tomados de los libros o consignados en las poesías clásicas.

Se vé, por lo tanto, que sin ser JÂḤIẒ un zoólogo de profesión, procuró recoger con curiosidad infatigable y seleccionar con cierto esmero los materiales de su libro, el cual ofrece por ello un interés documental, no despreciable, para la historia de la zoología en particular y de otras ciencias físicas, naturales y antropológicas. Este interés documental es el que me ha movido a divulgar entre los zoólogos, que no son arabistas, el cuadro general de las materias que el libro de JÂḤIẒ contiene, como preámbulo indispensable para su más amplio y profundo estudio. El desorden con que ya hemos dicho que está redactado exigía, para ese estudio, une previa reorganización sistemática de sus materiales. No siendo yo tampoco zoólogo de profesión, mi tarea ha tenido que limitarse a la de mero informador. Una lectura, no muy detenida, de los siete volúmenes del libro, me ha permitido recoger metódicamente en cédulas los temas científicos estudiados por JÂḤIẒ, separar los puramente filológicos y ordenarlos todos sistemáticamente bajo rúbricas que facilitarán investigaciones ulteriores y darán ya desde ahora una idea bastante sugestiva del valor singular de este libro. Una observación general he de hacer, antes de transcribir el inventario de las cédulas recogidas : los textos citados en ellas no siempre contienen un tratado extenso de las respectivas materias, sino frecuentemente alusiones tan sólo fugaces a ellas; útiles, sin embargo, desde el punto de vista histórico. En cinco grandes partes he creído cómodo distribuir las materias : ciencias físicas y químicas; zoología; antropología;

ciencia de las religiones; temas filológicos o literarios. El núcleo principal del libro es, como se comprende, la descripción particular de los animales, que ordenaré alfabéticamente para la más cómoda busca de los textos, relativos a cada uno. El resto de los pasajes científicos los he ordenado con arreglo a un criterio sistemático, es decir, por afinidad de materias dentro de cada ciencia.

Para completar de alguna manera esta visión de conjunto, añado al inventario la traducción de varios pasajes escogidos, que sirvan de muestra para apreciar el valor científico del libro y su estilo peculiar. He elegido temas de física *(el fuego en las minas)*, biología *(el mimetismo animal* y *la lucha por la existencia)*, zoología propiamente dicha *(las hormigas)* y finalmente un análisis con extractos del extenso tratado sobre la castración de los animales y del hombre, que está lleno de datos interesantísimos para la biología, la psicofisiología sexual y la historia de las costumbres.

INVENTARIO DE MATERIAS

I — FISICA Y QUIMICA

El mundo astronómico es inorgánico, pero viviente (I, 13). — Estrellas fijas (VI, 169). — Medios naturales e instrumentos para averiguar la hora (II, 107). — Verano e invierno (V, 36). — Distinta velocidad de la luz y del sonido (IV, 131). — Problemas de física térmica : el calor, el fuego y la luz; realidad objetiva del calor y de otras cualidades sensibles; mecanismo de la combustión (V, 2, 3, 5); fuego, su naturaleza y propiedades (V, 33); ventajas del calor; su influjo en las minas (V, 35); afinidades entre el fuego y el hombre; el fuego en las minas; la lámpara y la vida del hombre (V, 37); fuegos fatuos (V, 41); animales y maderas incombustibles (V, 95); rayo (IV, 104). — El agua : su naturaleza y propiedades; sus transformaciones en otros líquidos; idem en fluidos y sólidos; sus varios colores (V, 31-32). — Por qué flotan los cadáveres, (V, 40). — Elogio del agua (V, 45). — El agua, ingrediente de todas las bebidas (V, 48). — Congelación del agua (V, 25). — Virtudes de la nieve (V, 24). — El aire : su naturaleza y propiedades (V, 15). — Experiencias físicas con el aire (V, 39). — Las cometas o *milorchas* de los niños (IV, 20).

— Cualidades sensibles (V, 20-21). — Colores (III, 75, 77; V, 20, 100).— Aromas de varios países (VII, 71).— Excremento humano : su hedor (III, 4, 102). — Retrete o excusado (V, 91). — Hedores (I, 116). — Clima de la Arabia (V, 25). — Atomismo (V, 20). — Química del oro, plata, vidrio y piedras preciosas (V, 19, 106; III, 116). — Posibilidad e imposibilidad metafísica y física : lo inverosimil en física no es imposible (III, 115-117). — El imán (IV, 39). — Fenómenos naturales maravillosos (IV, 104). — Maravillosos efectos del sonido : música y canto (IV, 63).

II — ZOOLOGIA

A) GENERALIDADES SOBRE LOS ANIMALES

Los cuerpos orgánicos o vivientes y los inorgánicos o no vivientes (I, 13); dos especies de vivientes : vegetales (12) y animales. — Clasificaciones zoologicas; general : animales que andan, vuelan, nadan y reptan (I, 14-15; IV, 90). — Otras clasificaciones : por los medios de expresión (I, 16); animales aereos, acuáticos y terrestres (VI, 135); carnívoros, herbívoros y mixtos (VII, 48); salvajes y domésticos (IV, 16); pájaros ciudadanos (V, 66); aves herbívoras, carnívoras y mixtas (V, 66); animales comestibles (IV, 14; VI, 128, 131); animales que guardan el dinero (VI, 163); animales que no mueren, aunque se les ampute algún miembro (VI, 163); animales cornudos (VII, 77); animales de pezuña (VII, 75); animales necios, bellos y feos (VII, 14) ; animales especiales de la India (VII, 50); idem citados en el *Alcorán* (IV, 12); animales que se medicinan por instinto (VII, 13); recetas medicinales, hechas con animales (VII, 28). — Sentidos de los animales (VII, 2, 6-7); ojos de varios animales (IV, 77); ojos que brillan en la oscuridad (V, 100); animales que ven de noche (III, 167); fino olfato de algunos animales (IV, 129); animales sordos (IV, 123). — Animales que digieren piedras y cosas duras (IV, 102). — Armas de los animales para defenderse (VI, 124). — Caza ingeniosa de aves acuáticas (V, 156). — Animales con jefe (V, 126, 155). — Modos de andar de varios animales (V, 68). — Corpulencia de ciertos animales (pez, cancro, serpiente, dragón de mar etc.)

(12) Son contados los textos relativos a vegetales, v. gr. : VI, 120, sobre el nenúfar y el girasol; VII, 3, sobre qué clase de uva es la mejor etc.

(VII, 33). — Animal marino que no es pez y que salva al náufrago sosteniéndolo sobre sí (VII, 42). — El aliento de las fieras y alimañas derrite la nieve en la boca de sus madrigueras (VI, 164). — Mimetismo animal e influjo del medio físico (IV, 24; V, 112). — Casos de muerte aparente (III, 109).

B) PROBLEMAS RELATIVOS A LA GENERACION

La generación espontánea. (III, 112, 114; V, 106, 152). — Características sexuales en los animales y el hombre (V, 67). — Síntomas de la pubertad en el hombre y la mujer (II, 12). — Psicología sexual (I, 77). — El celo o instinto sexual (III, 78; 167; V, 95; VII, 7). — Análisis del instinto sexual en la mujer; influencia del vino y del canto (III, 91). — Influencia del excremento del elefante en la esterilidad de la mujer (VII, 27). — El amor sexual del diablo a las mujeres y los ataques epilépticos (VI, 67, 81). — La cópula o unión sexual en los animales (I, 49; VII, 77, 78).— Casas de prostitución en la India (VII, 2). — Vicio de la bestialidad (III, 63). — La continencia es garantía de larga vida; la castidad de los monjes cristianos (I, 62; VII, 68). — La circuncisión y su influjo en el apetito sexual (VII, 11). — La circuncisión de hombres y mujeres, entre judios, cristianos y musulmanes (VII, 11). — MAHOMA y JESÚS nacieron circuncidados (VII, 11). — Las mujeres bizantinas, indias y persas son más adúlteras que las árabes, por no circuncidarse (VII, 12). — Fecundidad de algunos animales (IV, 56). — Huevos; su número y tamaño; dónde y cómo los ponen los animales (II, 126; VII, 19, 21). — Fecundidad de las mujeres bizantinas y cristianas (IV, 56). — La lactancia en los animales (VII, 16). — Número de mamas en distintos animales (VII, 70). — Los testículos y la generación (I, 56). — Castración (I, 48, 59). — Especies de castrados (I, 55). —Castración de los eslavos y de los naturales del Khorasân, India, Nubia, Abisinia y Sudán (I, 53-54). — Castración entre los monjes cristianos griegos y entre los monjes sabeos (I, 57). — Efectos de la castración : apetito voraz, cambio de voz, caída del pelo, viveza intelectual etc. (I, 50-53, 61, 72). — Mujeres barbudas (I, 52). — Si es o no lícito comprar y vender eunucos (I, 74). — Dotes del eunuco (I, 76). — Castración de las bestias (I, 59, 82). — Si es o nó útil y lícita (I, 73). — Animales y plantas hermafroditas (VII, 49). — Cruce de especies zoológicas (VII, 76).

—Transformación de unas especies zoológicas en otras, incluso la humana (IV, 23; VI, 24). — Animales híbridos (I, 65). — La jirafa, producto híbrido de pantera y camello (VII, 76). — Eugenesia (I, 68). — Seres híbridos fabulosos: genios, ángeles, Dhū'l-Qarnayn, Gog y Magog etc. (I, 84-87). — Herencia psicológica (I, 68). — Niños nacidos con dientes; idem, a los treces meses; otros casos extraordinarios de nacimiento anormal (VII, 40-41).

c) LOS ANIMALES EN PARTICULAR

Abeja (V, 126). — Excelencias de su miel (V, 129).

Abubilla (III, 160). — Su nido, hecho con excremento (III, 161).

Aguila (VI, 107; VII, 14). — Su instinto (VII, 10).

Alacrán (IV, 72; V, 107).

Araña; sus variedades; arte delicado de su tela (V, 123-125).

Asno (II, 93).

Avestruz (IV, 103, 109, 147).

Avispa (VII, 12).

Avutarda (V, 133).

Ballena (V, 110). — Su estupidez, en comer el ámbar (VII, 35). — Como la ahuyentan los marinos (VII, 34). — Relatos hiperbólicos de los marinos acerca de la ballena (VII, 33). — El mito indio del pez colosal que sustenta la tierra (VII, 35).

Caballo de guerra (VII, 48). — Caballo de mar (VII, 79). — El caballo del Nilo que devora al cocodrilo (VII, 42, 46).

Cabra (V, 135).

Camaleón (VI, 120).

Camello (I, 70). — Discusión entre Cosroes y un árabe sobre las excelencias del camello (VII, 58).

Carnero (V, 135).

Cerdo (IV, 13). — Su suciedad, fealdad, ferocidad y celo sexual; sus colmillos (IV, 17-18). — Ilicitud de su carne (IV, 21, 25). — El cerdo montaraz mata al león (IV, 33).

Ciervo, su instinto; su caza (IV, 135; VII, 12).

Cocodrilo (VI, 113; VII, 42, 46).

Cuervo (II, 115; III, 127). — Sus variedades (III, 140). — Su vuelo y los agüeros (III, 135, 142).

Culebra (cfr. *Reptiles*).

Elefante (VII, 3, 22, 51). — Plan del tratado sobre el elefante (VII, 23). — Su corpulencia (VII, 33). — Su fuerza (VII, 35). —

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III. ANTROPOLOGIA

A) TEMAS DE PSICOLOGIA HUMANA INDIVIDUAL

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c) TEMAS DE PSICOLOGIA COMPARADA

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IV. RELIGIONES Y SECTAS

Ateos : su doctrina (V, 14; VI, 85; VII, 5). — Apología de la fé religiosa, basada en la providente sabiduría de Dios, tal como se revela en el cosmos y singularmente en el tamaño, figura, belleza, canto, instinto etc. de los animales, sobre todo, las aves y los insectos dañinos (II, 38-39; III, 92; IV, 32; V, 49). — Religión *judàica* : los diez castigos de Adán, Eva y la serpiente, por el pecado original (IV, 66); los diez castigos de la tierra, por haber bebido la sangre de Abel (IV, 67); la higuera es el árbol del paraíso (I, 97); leyendas del diluvio universal (II, 117; V, 106);

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154); semblanza del mu'tazil AL-NAZZÂM (II, 83); crítica del tradicionista KA'AB ALAHBÂR (IV, 67). — *Supersticiones* (IV, 96) : genios y ángeles (I, 86; VI, 14, 90); especies de genios y sus nombres (VI, 58, 72); fuego de los genios (IV, 153); edificios construidos por los genios (VI, 57); genios y demonios de Siria e India (VI, 72); aparición de fantasmas y genios, en figura de hombres, toros, águilas etc. (VI, 48, 63, 68); personas muertas por los genios (VI, 64); los genios inspiran a los poetas, (VI, 69-71); la creencia en los genios que viven en las ruinas, explicada por la depresión psicológica que producen la soledad y el desierto (VI, 66, 77); diablos íncubos y súcubos (VI, 60); la epilepsia y la peste, efecto del diablo (VI, 67); la evocación de los espíritus, diablos y genios, entre los musulmanes, los indios y los cristianos (VI, 61-62); fenómenos preternaturales (II, 50); adivinación (VI, 62); agüeros (III, 142); mal de ojo (II, 51); talismanes en ciudades contra alimañas (V, 120); leyenda de los ángeles Hârūt y Mârūt con Venus (I, 86; VI, 61).

V. TEMAS FILOLOGICOS

Onomástica : nombres derivados de *huevo* (IV, 110); frases en que entra esta voz (II, 123); nombres de las crias de los diversos animales (VI, 126); nombres de aves, derivados, por onomatopeya, de su canto (III, 162); nombres propios de persona, derivados del *elefante* (VII, 57); nombres de buen agüero (VI, 65); piropo a la mujer bella (V, 47); nombres de mal agüero, por comenzar con la letra *shîn* (III, 7); apodos de animales, formados con el nombre « *judío* » y nunca con el nombre « *cristiano* » (VI, 162); nombres de animales, aplicados a los hombres por desprecio; idem, aplicados por elogio a las esclavas, estrellas y constelaciones (I, 99); elogios que implican vituperio (V, 53); diminutivos (I, 164) ; nombres hebreos (IV, 9). — ***Paremiología*** : refranes de animales (I, 88, 104; VII, 4) ; del asno (II, 93). — ***Poesía árabe*** : su reciente origen (I, 37); las dotes poéticas no dependen de causas físicas, ni étnicas (IV, 122); el plagio poético (III, 96); la traducción de los versos árabes (I, 37); enseñanza de la poesia (I, 31); la belleza y el juicio estético (III, 28; IV, 34). — ***Cuentos*** : indecentes u obscenos (III, 4, 7, 8; VI, 153, 160; VII, 74); supersticiosos (III, 139); de agudeza o ingenio

(I, 182; II, 131-132; III, 11, 38); cuento del hombre que sigue a una mujer bella (III, 11); del lazarillo (III, 9); del que no paga el *azaque* (III, 8); del huesped glotón que se come la mejor porción (II, 130); cuentos de AL-MAKKÍ (III, 101); otros cuentos (III, 3, 4, 5, 6, 8, 9, 10, 11, 38, 87, 88, 101, 106, 124, 139; IV, 39, 42, 49, 134; V, 115, 119, 138; VI, 37, 73, 74, 81, 82, 114, 153, 160, 166, 167; VII, 74, 83); fábula del viejo y los pájaros (V, 75). — *Varia* : versos y anecdotas de ingenio (III, 144); dichos y sentencias (V, 171; VI, 172; VII, 61); etimologias ridículas (V, 72); fórmulas para ponderar la imposibilidad (V, 153).

PASAJES ESCOGIDOS

A) EL FUEGO EN LAS MINAS
(*Ḥayawân*, V, 37)

« Yo he observado que el hombre vive allá donde el fuego vive, y, en cambio, muere y se extingue el fuego, allá donde muere el hombre y se extingue su vida. Penetra a veces el fuego en ciertos subterráneos, pozos, cuevas y minas, y observas que, si muere allí, conocemos que el hombre, cuando se encuentre dentro de aquel lugar, morirá también. Por eso, no penetra jamás en tales lugares nadie, mientras perdura el fenómeno de extinguirse en él el fuego. Por eso, los trabajadores de las minas y de los pozos, cuando se lanzan a abrirse paso en el seno de la tierra o en una cueva y a penetrar en sus profundidades y repliegues, se previenen llevando ante sí una antorcha, en cuyo extremo o punta encienden fuego; si éste se mantiene encendido y no se extingue, penetran en busca de los minerales preciosos, oro etc. ; pero si se apaga, no se exponen al peligro. Entran, pues, o se abstienen de entrar, según que el fuego vive o muere. Asimismo, cuando, al asomarse a la boca del pozo, notan hedor, no osan descender a él, hasta después de echar al fondo del pozo una cuerda, en cuyo extremo vá un candil encendido, u otra cosa que haga sus veces : si muere, no se exponen. »

B) EL MIMETISMO ANIMAL
(*Ḥayawân*, IV, 24; V, 112)

« No negamos que el aire se corrompa en un país cualquiera y

que asimismo se corrompa su agua y su tierra y que ello ejerza su influjo en los temperamentos de los que lo habitan a la larga, tal y como influye en la complexión de los etiopes, de los habitantes del país de los eslavos y de los Gog y Magog. A veces hemos visto a los árabes que, siendo beduinos, han venido a habitar en el Khorasân, cómo llegaron a perder todas aquellas cualidades que les eran características. Verás también cómo los caracteres físicos del país de los turcos imprimen su huella en las cualidades naturales de los camellos, bestias de carga y, en general, en todos los cuadrúpedos, sean fieras o sean bestias. Verás asimismo que las langostas de las verduras y de las plantas aromáticas, como el arrayán, y todos los gusanos de estos vegetales verdes, son también verdes, o los verás de otro color en las plantas que no son verdes. Verás también que son negros los piojos en la cabeza del joven que tiene negro el pelo, y en cambio los verás blancos en la cabeza del anciano de pelo blanco, y los verás grises en la cabeza del que tiene gris el cabello, y de color ceniciento en el pelo del camello de este color; y cuando están en la cabeza del que tiene el cabello tirando a color rojo, los verás rojos; pero si el cabello llega a perder su tinte rojo, toman entonces los piojos un matiz intermedio semejante, entre rojo y blanco. Nosotros vemos asimismo que el suelo rocoso de los Banû Salîm (13) y todo lo que encierra, asi hombres como fieras, bestias, aves e insectos, son, todos ellos, negros. »

c) LA LUCHA POR LA EXISTENCIA
(*Ḥayawân*, VI, 133)

« Sale la rata (*al-joradh*) a buscar su alimento, y para lograrlo se ingenia, comiendo todo otro animal inferior a ella en fuerza, tal como los animalitos y pájaros pequeños, los huevos y las crías de éstos y, en general, los bichos que no viven en madrigueras o cuyos nidos están a flor de tierra. A su vez, tiene que librarse de las culebras y de las aves y serpientes de presa, que la buscan para devorarla. También tiene que ingeniarse para defenderse del lagarto y del herizo, que son más fuertes que la rata. El lagarto no se ingenia para cazar, más que a la culebra y al zorro. Este, a su vez, caza a todos los animales que son inferiores a él. Los

(13) Falta este nombre tribal en los diccionarios geográficos árabes.

mosquitos salen a buscar su alimento y, como saben por instinto que lo que les hace vivir es la sangre, tan pronto como ven al elefante, al hipopótamo o a otros animales cualesquiera, conocen que su piel no ha sido creada, sino para que les sirva a ellos de alimento y, cayendo sobre ella, la atraviesan con sus trompas, seguros de que sus lanzadas son bien penetrantes y capaces de llegar hasta la sangre para extraerla. Salen a su vez las moscas, las cuales, aunque se alimentan de muchas y varias cosas, principalmente cazan al mosquito, que es el alimento que más les gusta. Si no fuese por las moscas, sería el daño [134] de los mosquitos, durante el día, mucho mayor. Salen la salamanquesa (*al-wazgha*) y la araña llamada *león* y cazan las moscas con la más ingeniosa de las artes y la máxima habilidad. Pero además las moscas desaparecen también por obra de otras causas, v.gr. mueren al comerse los manjares dulces a porfía. Los animales todos, en suma, no pueden pasarse sin alimento. El animal cazador no puede tampoco escapar de ser, a su vez, cazado. Todo animal débil devora al que es más débil que él. Todo animal fuerte, no puede librarse de ser devorado por otro animal más fuerte que él. Y en esto son exactamente igual los hombres, unos respecto de otros, aunque no lleguen a los mismos extremos. Dios, en suma, ha puesto a unos seres como causa de la vida de otros, y reciprocamente a éstos como causa de la muerte de aquéllos. »

D) DE LAS HORMIGAS
(*Ḥayawân*, IV, 2)

« Comenzamos esta parte [cuarta], con la ayuda de Dios y con su auxilio, hablando de las hormigas, chicas y grandes, según prometimos al terminar el tomo tercero..... »

« Si queremos ponerte un ejemplo típico de maravilla y de admiración, que sugiera cuán grande es la providencia, habremos de traer a colación al animal más vil, pequeño, abyecto y despreciable, haciéndote ver la sutil sensibilidad que posee, su admirable previsión y preocupación de las consecuencias, su semejanza y parecido en esto con el hombre, siendo como es el hombre el rey de la creación a cuyo dominio está sujeto el orbe entero con todo cuanto encierra. Sabemos, en efecto, que la hormiga almacena para el invierno durante el estío, previniéndose así de antemano y sin desfallecer en su firme propósito ni un solo momento,

mientras le es posible almacenar. Después, su experta sagacidad y previsión de las consecuencias llega hasta el extremo de que, ante el temor de que las semillas, almacenadas durante el verano para el invierno, se pudran y gusanen en el seno de la tierra, las saca a la superficie, para que se sequen y tornen a su estado normal, dándoles el aire y evitando así su corrupción y podredumbre. Después, como a menudo o, mejor, casi siempre, el lugar en que almacena las semillas es húmedo, teme la hormiga que germinen por la parte central del grano, cubierta de una fina película (pues sabe muy bien que por ese punto es por donde la semilla comienza a germinar y a transformarse en planta), y así la hormiga hiende el grano entero en dos mitades, y si es de coriandro o cilantro (*al-kozbora*), lo hiende en cuatro partes, porque la semilla de esta planta es la única que tiene la propiedad de germinar en sus dos mitades. Hasta tal extremo aventaja la hormiga, por este solo hecho, a la sagacidad de todos los animales, que quizá es más prudente que muchos hombres. A pesar del exiguo tamaño de su cuerpo y de su poco peso, la hormiga posee también un olfato, como ningún otro animal, pues a veces ocurre [3] estar un hombre comiendo langostas o cosa semejante y cáersele de la mano una o un trozo de ella; y aunque no haya visto, por allí cerca, ni una sola hormiga, ni de que existan en tal lugar haya la menor noticia, no pasa mucho rato sin que aparezca una y, encaminándose derechamente a la langosta que cayó en tierra, intente con todo empeño darle una vuelta y llevársela a rastras; y si se siente incapaz de lograrlo, tras inútiles tentativas, marcha de regreso a su hormiguero, y no pasa mucho rato sin que aquel hombre la vea volver, seguida de una fila negra y extensa de hormigas, para que la ayuden, y se llevan a rastras la langosta. Lo primero, pues, que observamos aquí es la fiel veracidad de su olfato, para barruntar lo que no advertiría ni el hombre hambriento. Después, la audacia y tenacidad del empeño en transportar una carga, que es cien veces, o más de cien veces, mayor en peso que el suyo propio, pues no hay animal alguno capaz de cargarse, como lo hace la hormiga, un peso que sea superior un muchos múltiplos al de su cuerpo mismo, sin desistir jamás de la empresa, si no es tras sentir agotado su aliento. Pero quizás alguien diga : « Y ¿ cómo sabe el hombre que la hormiga aquella que quiso llevarse la langosta sin conseguirlo, es precisamente la misma que trasmitió la noticia

a sus pequeñas compañeras y la misma que viene luego a la cabeza de ellas? » A esto responderemos que por una larga experiencia, pues jamás hemos visto que una hormiga intente arrastrar una langosta y no pueda conseguirlo, sin que poco después, si es que vuelve, venga acompañada de otras hormigas. Y si bien es verdad que no podemos a simple vista distinguir aquella hormiga de sus compañeras, también es cierto que no cabe concebir otra hipótesis que la que hemos dicho, pues además nunca hemos visto alguna que, si al volverse al hormiguero, cargada con una presa o sin carga, se topa con otra hormiga, deje de detenerse junto a ella y contarle alguna cosa, lo cual es indicio de que, al abandonar aquella hormiga a la langosta, lo hizo para informar a sus semejantes, como lo hace el explorador, que no engaña a sus compañeros de caza..... »

[11] « Las especies de animales que almacenan víveres y que en esto se parecen al hombre dotado de reflexión, prudencia y previsión del porvenir, son las hormigas, chicas y grandes, el ratón, el lagarto, la araña y la abeja, si bien la abeja no almacena más que un solo género de alimentos, que es la miel. »

« Pretende AL-JAQṬORÎ que, si introduces una hormiga grande en un hormiguero de hormigas chicas, se las come todas, sin dejar una; y afirma, además, que esto lo ha experimentado él mismo. El autor de la lógica [ARISTÓTELES] dice que la hiena devora rápidamente las hormigas, pues se va al hormiguero, cuando están en él todas juntas, y se las come, lamiéndolas con la lengua, con una avidez devoradora y un apetito intenso. Dicen también que, a menudo, ocurre que el gusano *teredo* (*al-'arada*) haga grande estrago en las aldeas, devorando todo cuanto encuentra en las casas; y la plaga dura sin cesar, hasta tanto que en aquellas aldeas se instalan las hormigas, pues Dios otorga a éstas tal dominio sobre aquellos gusanos, que no dejan uno vivo. Claro que, a su vez, las hormigas, después de aniquilarlos, quedan allí también y son una plaga, aunque menos dañina que los dichos gusanos. Eso, a parte de que, a menudo, sucede que también desaparecen luego las hormigas de aquellas aldeas, y así quedan sus habitantes libres de ambas plagas juntamente. Hay quienes pretenden que aquellos gusanos se transforman en hormigas, en lugar de desaparecer, devorados por éstas, y que, a medida que se van transformando en hormigas, va disminuyendo su número y menguando así por días su daño. »

« Las hormigas son proverbiales por su multitud, y así se dice : « Vinieron como hormigas. » Los etiopes son de dos especies : unos, que se glorían por su muchedumbre, se llaman « las hormigas »; otros, que se glorían por su paciencia y corpulencia, se llaman « los perros »; los unos están siempre tumbados; los otros siempre en movimiento : aquéllos son los perros; éstos las hormigas. »

« Una de las causas de la muerte de las hormigas es el salirles alas. Ya lo dijo el poeta :

« Y cuando a la hormiga le nacen alas para volar, cercano está su fín. »

« Y es que, una vez transformadas así las hormigas, los pájaros las cazan fácilmente al volar. También se matan las hormigas, derramando alquitrán y azufre en las bocas de sus hormigueros, sembrados, previamente, de granos de cebada. Nosotros hemos hecho la prueba, pero resulta inútil. »

E) CAPITULO QUE TRATA DE LOS EFECTOS QUE LE SOBREVIENEN AL HOMBRE, DESPUES DE LA CASTRACION, Y DE LOS CAMBIOS QUE EXPERIMENTAN LAS CUALIDADES QUE POSEIA ANTES DE SER CASTRADO. (*Ḥayawân*, I, 48).

« Dicen que, excepción hecha del hombre, a todo otro animal que tenga fétido el aliento o que le huelan mal los sobacos o las narices (v. gr. el águila u otros animales semejantes) le disminuye el hedor o le desparece el aliento fétido, si se le castra. El hombre eunuco, en cambio, adquiere por la castración un hedor más intenso y repugnante, así su aliento como sus sobacos, y además se extiende a todo su cuerpo la corrupción de su sudor, hasta el punto de que encuentras que sus cuerpos despiden un hedor característico, que no se nota en los que no son eunucos. Este es uno de los efectos de la castración. »

« A todo animal que es castrado se le adelgazan los huesos y, al adelgazar los huesos, su carne se hace fofa, se desprende de los huesos y se torna blanda y delicada, después de haber sido musculosa y dura. Al hombre, en cambio, si se le castra, sus huesos le crecen en longitud y latitud. Difiere, por lo tanto, también en esto de los demás animales. »

« A los eunucos les sobreviene además un aumento de longitud en los pies, un cierto retorcimiento en los dedos de la mano y

encorvamiento en los dedos del pie. Esto acaece, desde que empiezan a entrar en la senectud. »

« Les sobreviene también un rápido cambio, alteración y trastorno en las cualidades de la piel, que pierde su blandura, finura, pulimento y tersura, la pureza de su color, su humedad y su brillo, cubriéndose en cambio de arrugas, quedando mustia, contraida, mortecina, atrofiada y en mal estado. Esto que les pasa a los eunucos es lo que les pasa también a las hijas de los labriegos, de los que cultivan los cereales y las palmeras. Porque ves al eunuco, antes de ser castrado, y es como si las espadas brillasen en su color, cual si fuese un espejo de la China, lo mismo que una lámina de metal bruñida, como la médula húmeda de la palmera, como una vara de plata sobredorada, cual si en sus mejillas hubiese rosas; pero luego, no pasa mucho tiempo y todo esto desaparece para no volver más, aunque lleve una vida de bienestar y de abundancia, exenta de preocupaciones y trabajando poco... »

[49] « Dicen que el eunuco no se hace calvo, como tampoco la mujer. Y es que cuando se le mutila por completo el miembro por el cual es macho, la amputación le priva de la mayor parte de las cualidades esenciales de la virilidad, y al quedar privado de esta perfección, viene a ser como el mulo, que ni es asno ni caballo : su complexión natural, en efecto, queda como dividida entre la complexión del macho y de la hembra, sin que tenga los caracteres simples de la pura masculinidad, ni tampoco los de la feminidad pura, sustituyendo a aquéllos; antes por el contrario, su complexión es mixta y compósita y da por resultado algo indeciso, que ni pertenece a los machos ni a las hembras... »

« El hombre posee varias potencias, cuya importancia es bien conocida, ciertos apetitos destinados a la satisfacción de necesidades anímicas, que no cabe suprimir ni privarles de sus operaciones propias, mientras el alma subsista con sus propiedades naturales, con sus temperamentos y necesidades. El apetito de la unión sexual es uno de los mayores, de los más intensos y comunes. A este apetito pertenece la natural inclinación, que en los hombres existe, a tener hijos. Es ésta una de sus más fuertes inclinaciones. Unos buscan tener hijos para lograr numerosa familia que les sirva de ayuda en sus necesidades... Muchos buscan tener hijos, para evitar que su patrimonio vaya a parar a sus parientes remotos.... A veces los buscan, para perpetuar su nombre

mediante la descendencia..... para multiplicar el número de los musulmanes..... para enriquecerse con el concurso de los hijos, para defenderse de sus enemigos, y por último para conservar la especie humana y cumplir así el fin natural, que Dios ha puesto en el hombre, de amar [50] la propagación y multiplicación propia, como la aman las palomas y los gatos, aunque con los hijos aumenten en el hombre las preocupaciones y los trabajos, la cobardía y la avaricia..., pues tiene que procurarse subsistencias en mayor cantidad para los hijos y soportar preocupaciones ajenas al fin a que tiende la unión sexual, que no es más que la satisfacción del apetito natural..... De todos los animales que se aparean sexualmente, el hombre es el único que frustra el coíto cuando no le place el tener hijos; los otros animales, de cualquier especie que sean, tan sólo buscan y apetecen la efusión del semen y la generación, porque a ello les fuerza la inclinación natural que Dios puso en ellos, a fin de que así puedan llenar las necesidades del hombre. El asno no busca el tener hijos, cuando se une con la hembra; pero no frustra el coíto como el hombre lo frustra, pues el único propósito que le mueve es el satisfacer el apetito sexual y no más, sin que le venga a las mientes que de aquel líquido se engendre algo. »

« La mayor parte de lo que los hombres ganan y gastan, así como la mayor parte de sus preocupaciones, fatigas y artes que emplean para guardar lo que poseen, se consume tan sólo para y por las mujeres y las cosas que con ellas se relacionan. Aunque no fuera más que para depilarse, perfumarse, vestirse y teñirse y para las cosas necesarias a estos fines, es decir, los perfumes, los tintes, los mantos y las túnicas, los tapices y los vasos, ya sería bastante; y aunque el hombre no tuviese sino la preocupación de guardar y vigilar a las mujeres y el miedo del deshonor que le puede sobrevenir por culpa de ellas o de otros con ellas, ya sería esto solo muy grave cuidado y molestia terrible. »

« Ahora bien, cuando desaparece el miembro por cuya causa el alma del hombre vive ocupada en tantas variedades de placer y dolor, forzosamente tienes que reconocer que aquellas potencias no por ello desaparecen del organismo ni las pierde la naturaleza humana. Lo único que les sucede es que un obstáculo se alza para ellas y que un velo las separa de su objeto. Si pues continúan existiendo, es indispensable que ejerzan alguna función,

pues la operación de toda sustancia no desaparece, sino con la desaparición del ser de la sustancia misma. Luego si a dichas potencias se las desvía de su dirección, su energía tiene que desbordar en otra dirección distinta; singularmente si están pletóricas de vida y si su actividad en plena tensión y fervoroso rebosar se ve cohibida, es inevitable que fluya, o bien que se abra paso a si misma, a través de otra puerta. Ahora bien, después de la unión sexual, no le queda otra puerta de desahogo que el alimento. Concéntranse pues entonces todas aquellas energías que tienden a la unión sexual y que con esta unión sexual se relacionan, y vienen a fundirse con la potencia o facultad que tiende a la nutrición; y claro es que, una vez juntas ambas potencias y aplicadas a un solo y el mismo objeto, su fuerza es más intensa y su capacidad funcional más amplia. Por eso el eunuco comienza a comer mucho más que cualquiera de sus hermanos; y en la misma medida que come, digiere; y la cantidad que come, está en razón directa de la mayor necesidad que de comer tiene su complexión y del calor vital engendrado por el movimiento [51], pues el apetito sexual es el más sucio estímulo para comer, y el movimiento es una de las causas más eficaces del calor vital. Por eso las hembras comen más frecuente y seguidamente que los machos. Así también, el asno come menos veces que el caballo, y el asno de montar menos que el asno de carga y menos también que el carnero. Las mujeres es cierto que comen menos que los hombres, a las horas acostumbradas para la comida en las casas : es indudable, en efecto, que el hombre come en una de esas comidas lo que no come la mujer; pero en cambio la mujer se desquita luego, alimentándose más veces entre horas, sin orden ni concierto, y así, a fuerza de estar comiendo constantemente, resulta mayor la cantidad total de lo que come. Bajo este aspecto, se parecen las mujeres a los niños, pues la complexión del niño es también esa : digerir rápidamente, para sentir pronto un hambre canina; pero comer poco rato y poca cantidad cada vez. Tiene pues el eunuco de común con la mujer el comer, como ella, muchas veces seguidas, si bien se distingue de la mujer en que, por añadidura, come mucho más que ella cada vez. De modo que son dos causas de aumento, en favor del eunuco : una, esa que le asemeja a la mujer, y otra, la concentración de las energías de sus dos apetitos, aplicados a un solo objeto, quiero decir, el apetito sexual, desviado

de su función propia, y el apetito de la nutrición. Preguntáronle a un árabe beduino cuál fuese el animal más voraz, y respondió : la burra de carga que amamanta a sus pollinos. Por esta mayor voracidad de las hembras, es la leona más feroz y agresiva, cuando busca al hombre para devorarlo. Por eso también, las hembras de las especies zoológicas cazadoras, como las perras de caza y otros animales parecidos, son más ávidas durante el periodo en que dan de mamar a sus cachorros, pues la lactancia es para ellas una causa especial de apetito y voracidad. »

« Sobreviene también al eunuco, al amputarle el miembro, un cambio de voz, hasta el extremo de que quien le oye hablar, sin verlo conoce con evidencia que es eunuco, aunque la persona que le hable y converse con él sea su hermano, su primo o uno de sus amigos, varones y de su mismo linaje. Este accidente ataca más a los eunucos de los eslavos, que no a los del Khorasân y a los negros de la India y Abisinia. Muy pocos serán los que encuentres faltos de esta cualidad, sin que tengan uno de los dos testículos. Y para distinguir este síntoma con toda certeza, no es necesario aguzar los sentidos ni tener una sagacidad excepcional, sino que, antes bien, encontrarás que la cosa es pública y notoria, hasta entre las gentes de la más baja extracción y aun entre las mujeres y los niños. »

« Si el eunuco ha sido castrado antes de que le nazca el pelo, ya no le nace; y si se le castra después de nacido completamente, se le cae de todos los lugares en los que el pelo nace, excepto del pubis, pues el pelo de esta parte, si bien amengua su grosor y disminuye su abundancia, sin embargo el que queda sin caer es todavía bastante. Este accidente no afecta al pelo de la cabeza, de los párpados y de las cejas, que nace con el sujeto, sino tan sólo al pelo que nace después en el resto del cuerpo. Algunos, sin embargo, pretenden que el cabello tiene mayor arraigo que el pelo de las cejas..... Las mujeres, los eunucos y los hombres que no han perdido la virilidad son, pues, iguales, en lo que atañe a la conservación de ese pelo. El accidente de caerse afecta sólo al resto [52] del pelo que nace después, porque sus raíces son nuevas. »

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« Las zonas en que termina el pelo de la cabeza y el de la frente no son iguales en el eunuco y en la mujer : en la mujer, al llegar

el pelo cerca de esas zonas de la piel, en que desaparece y la piel es ya suave al tacto por estar desnuda de pelo, hácese el pelo más fino y escaso progresivamente, hasta desaparecer por completo; en el eunuco, por el contrario, los pelos de toda la zona son de la misma cantidad y de un mismo grosor, hasta llegar al límite de la zona, en el cual desaparecen de repente. En la mujer asimismo se da el caso de que tenga largas cejas, dotadas de pelos finos y sedosos, como el vello que cubre las mejillas, y esos pelos finos se unen sin solución de continuidad con el pelo de las sienes. No le ocurre esto al eunuco, si no es por defecto en la castración : no se le ve, en efecto, nada de pelo, ni fino ni grueso, más allá del sitio en que terminan de repente sus patillas. Se ven alguna vez mujeres dotadas de barba. Yo las he visto, y las más de las veces ha sido tratándose de viejas..... Así mismo, también las he visto alguna vez, que tenían perilla y bigote. A simple vista, tales mujeres no son hermafroditas, sino perfectas hembras, a no ser que..... el pelo aparezca también en otros lugares distintos. Esto no ocure con el eunuco. La gente de Bagdad cuenta que una de las hijas de MUHAMMAD IBN RÂSHID AL-KHANNÂQ tenía barba muy poblada y que penetró en una casa donde se celebraba una boda, con las mujeres que iban, como ella, veladas, para ver a la novia y presenciar el desposorio; pero una mujer se dió cuenta y gritó : « ¡ Dios ! ¡ Un hombre ! »; y, al grito, cayeron sobre ella los criados y las mujeres a golpes, de modo que no tuvo más remedio, para salvarse, que descubrirles su órgano sexual, y así la dejaron libre, aunque estuvo a punto de morir. »

« También gana a la mujer el eunuco en la desnudez del cutis, es decir, en tenerlo menos cubierto de vello. Encuentras, efectivamente, que la mujer tiene vello en los brazos y en los pies; hasta sus rodillas están cubiertas, a veces, con tanto pelo como el pubis del hombre; y en sus sobacos y en otros lugares le sucede lo mismo. »

« Al eunuco tampoco le ocurre lo que al gallo cuando se le castra, es decir, que el cartílago de su cresta y su moco o barba se quedan mustios y caídos. Sin embargo, la castración amengua también en el eunuco la fuerza de los ligamentos orgánicos, disminuye la intensidad de sus potencias físicas y afloja las ataduras de los nervios, como si el sujeto se aproximase a la decrepitud, por desgaste del organismo. Así acaece que el eunuco tiene que hacer

fuerza, al asentar su pie sobre el suelo; tanto, que si observas las huellas de su pie y del de su hermano que no haya perdido la virilidad, encontrarás siempre, en su huella y en su manera de pisar, algo que no encontrarás en la de su hermano, como si el miembro que mantenía fuertemente tensas las venas ciáticas, los tendones de los muslos y los ligamentos de los nervios [53], al desaparecer y aniquilarse aquello que lo mantenía sujeto y suspendido, hiciese aflojar por ello la fuerza del pie, al posarse en el suelo, como organismo desarticulado, cuyas partes no se sostienen unas a otras.»

« Otro accidente le sobreviene al eunuco : si de dos esclavos de raza eslava, que sean hermanos de padre y madre y además gemelos, al uno se le castra y al otro no, el eunuco sale más dispuesto para el servicio, más sagaz, hábil y apto para las distintas faenas del trabajo manual, y hasta lo encontrarás también más vivo de inteligencia en la conversación. Todas estas cualidades resultarán privativas del castrado. En cambio, su hermano seguirá teniendo la misma torpeza nativa, igual falta de talento natural, igual imbecilidad, propia de los eslavos, e incapacidad para entender una lengua extranjera. La mano del hombre es siempre torpe, y jamás se torna diestra para las artes, mientras no la adiestran la inteligencia y el saber. La lengua, asimismo, no adquiere soltura y desparpajo para explicarse, ni logra facilidad en el uso de las palabras, sino después que el saber la penetra y la guia y le fija los lugares en que debe estar y los límites que le corresponden y le señala las normas eficaces para el acierto en los casos díficiles y le gobierna a todo evento. Lo primero, pues, que produce la castración en el eslavo, es aguzar su inteligencia, afinar su penetración, pulir su ingenio y avivar el ritmo de su alma. Y así, una vez que ya es inteligente, sus movimientos siguen dócilmente a su inteligencia y son ya proporcionados a su facultad. En cuanto a las mujeres y los niños de los eslavos, no hay recurso alguno eficaz para transformar sus torpes ingenios y hacerles adquirir ni sagacidad penetrante, ni movimientos acompasados, ni facultad de realizar trabajos fijos y acomodados a un fin. Es que, en razón directa de la ignorancia, está siempre la torpeza de movimientos; como la destreza, por el contrario, está siempre en razón directa del saber. Esta que decimos es la condición, en general, de las mujeres de los eslavos : son unas desgraciadas, mientras

viven en la soledad, y carecen de toda capacidad o aptitud para cualquier arte, porque les falta la facultad de comprender y hacerse cargo de las faenas propias de las artes manuales. Aun los mismos eslavos que son eunucos, no obstante poseer buenos instrumentos y a pesar de estar ya dotados, por la castración, de más abundantes aptitudes cognoscitivas para el ejercicio de distintos trabajos y de una complexión más equilibrada para las artes manuales, no verás, sin embargo, ni a uno solo de ellos que haya logrado jamás habilidad positiva en la práctica de un arte que implique cierta dificultad y que exija alguna dosis de saber práctico, asequible tan sólo mediante atención profunda y reflexión mantenida. Apenas si se cita, a este respecto, la habilidad de DÂMA en el manejo de las cuerdas(14), arte en el cual se hizo en verdad famoso por su destreza, no aventajada por nadie. También son habilísimos en el arte de cazar pájaros con liga y en el del reclamo de las palomas silvestres, los eunucos que han sido castrados en su infancia. Y dígase lo propio de cualesquiera otras artes de menor cuantía. Así, por ejemplo, ponderan los de Basora la destreza de KHADÎJÂ, criado de MOTHANNÂ IBN ZOHAYR, en el arte de educar las palomas mensajeras....., como lo explicaremos, si Dios quiere, en el capítulo en que tratamos de la paloma.»

« Esto es lo que dicen de los eunucos eslavos.»

[54] « En cuanto a la inteligencia de los eunucos del Khorasān, nuestros príncipes la elogian mucho más; pero son tan pocos en número, que por eso no podemos mencionar de ellos noticia alguna que sea famosa y divulgada. En cuanto a la India, tampoco ha habido entre sus habitantes más eunucos que los que castró MÛSÂ IBN KA'AB, de los cuales yo he visto a uno, el cual me aseguró ser de los cuatro que MÛSÂ castró. En este eunuco observé que la castración le arrastró a sentir grande afición por las palomas y por las peleas de gallos, cosa que no sentía en un principio, sino que experimentó, únicamente, después de haberle sido amputado el miembro. Por lo que toca a los eunucos de la Abisinia, de la Nubia y otros varios de raza negra, la castración les quita facultades sin darles otras, les amengua las dotes en vez de aumentárselas, haciéndoles decaer, respecto de sus hermanos de raza que no son eunucos; al revés de los eslavos, que al ser cas-

(14) Alude probablemente al manejo de instrumentos musicales de cuerda.

trados aventajan en dotes a sus hermanos que no lo son. Y es que el abisinio, cuando se le castra, decae de espíritu, se hacen pesados sus movimientos y desaparece su agilidad y viveza. No puede menos de sobrevenirle cierta degeneración, porque la castración total le priva de la facultad de retener la orina, la cual fluye, sin que él la pueda contener..... No encontrarás además eunuco alguno de esa raza, que no tenga, por la castración, una hernia umbilical... Ahora bien, estos son defectos terribles...., además de ser repulsivos a la vista. Pero todo lo que repugna de ver produce dolor moral al sujeto..... Son también muchos los eunucos de esta raza que carecen de dientes. Claro es que este defecto cae dentro de los labios; pero como los labios de los negros penden hacia fuera y quedan colgando, resulta más visible su falta de dientes.....»

JÂḤIẒ inserta a continuación (pág. 55) varias noticias históricas relativas a casos de eunucos que no lo fueron propiamente, pues su falta de virilidad se debió, bien a impotencia senil, bien a accidentes fortuitos, que les privaron total o parcialmente de la integridad de los órganos sexuales, aunque, a consecuencia de esta castración eventual, se vieron también afectados de algunos de los accidentes propios de los eunucos, v.gr. la afeminación en la voz, la desarticulación y flojera de los músculos, la pérdida de la barba, la voracidad etc. — Menciona luego (pág. 56) la castración operada por los médicos, a título de intervención quirúrgica en las dolencias que afectan al órgano sexual, amputando uno sólo o los dos testículos. A este propósito, se hace cargo de la creencia del vulgo, según la cual tan sólo el testículo izquierdo es el órgano eficaz de la generación, y la refuta con casos típicos en los cuales la supuesta ley salió fallida. — Estudia después la castración en las varias religiones. De los cristianos bizantinos dice que castran a sus hijos para consagrarlos al servicio de Dios, como guardianes de los templos; pero asegura que la castración entre ellos consiste sólo en la ablación de los testículos, dejando íntegro el pene, porque únicamente aspiran a frustrar la concepción en las mujeres, sin privarse por ello del deleite sexual, el cual, según JÂḤIẒ, creen los bizantinos ser más intenso en los eunucos, así castrados, que en los varones integros. Afirma también que a los griegos bizantinos se debe el origen de la castración en el mundo entero. «¡Cosa — comenta JÂḤIẒ — que maravilla, siendo, como son,

cristianos y presumiendo, como presumen, de corazón compasivo, caritativo y tierno, más que todos los otros pueblos, ya que la castración basta por si sola como indicio de la dureza de corazón de quien la inflige a otro ! » La castración entre los sabeos (pág. 57) practícase también por devoción, como entre los bizantinos, pero con una diferencia, en favor de aquéllos, a saber : que el devoto, a veces, se hace eunuco a sí mismo, sin imposición ajena. A este propósito se ocupa JÂḤIẒ por extenso en transcribir las confesiones del asceta sabeo ABÛ AL-MOBÂRAQ, que llegó a centenario, después de haberse castrado voluntariamente para refrenar su exacerbada concupiscencia, en servicio de Dios. Por lo que toca al islam, JÂḤIẒ declara prohibida la castración, practicada por motivos religiosos, invocando para ello la autoridad de MAHOMA que dijo : « La castración de mi pueblo es el ayuno ». — Estudia luego (pág. 59) la castración de los esclavos extranjeros, importados en tierras musulmanas para venderlos, y pondera la crueldad con que eran tratados, pues se les cortaba a cercén el pene y ambos testículos, sin temor de causarles la muerte con tan bárbara operación; y en el caso de salvar la vida y conservar un testículo o los dos, pero sin el pene, quedaban reducidos a la más abyecta condición moral, sin ser propiamente machos, ni hembras, ni eunucos, pues, aunque castrados, les sale a los tales la barba, y por eso nadie los admite en sus casas para guardianes del harén y servidores domésticos; de modo que ni gozan de las comodidades de la vida que los eunucos tienen, ni tampoco pueden aspirar a los placeres sexuales de los hombres que poseen la integridad viril. — A continuación, enumera las varias operaciones empleadas para la castración de las bestias, todas las cuales consisten, sin diferencia sensible, en ligar fuertemente ambos testículos desde la raiz del pene, a fin de que, privados de la irrigación sanguínea, vayan poco a poco marchitándose y secándose sus tejidos y atrofiándose las glándulas que segregan el semen (el cual, además, no encuentra expedito el paso, por el obstáculo de la ligadura) y al fin se desprenden y caen por sí mismos. En cambio, la castración de los hombres se realizaba por medio de un largo y afilado estilete, puesto al rojo vivo, con el cual se lograba rápidamente la amputación por cauterio. — Son varios los fines (pág. 60) por los cuales se castran los animales : las bestias y singularmente el ganado lanar, si se castra

cuando es joven, produce una carne más tierna, crasa y de mejor sabor. En cambio, los animales, sin castrar, se hacen más débiles y flacos, porque el uso excesivo de la cópula sexual produce estos efectos siempre. Al gallo se le hace capón con el mismo objeto de engordarlo y lograr que su carne sea más grasienta y tierna. Los árabes castraban los machos de los camellos, que por su edad provecta y peor raza éranles menos útiles para la procreación, dejando sólo sin castrar los jóvenes y más aptos para padres. Análoga selección hacían con los caballos. »

[61] « Otro de los efectos que produce la castración en el hombre es la facilidad de llorar, cualidad ésta que es habitual en los niños y, despues, en las mujeres, las cuales, lo mismo que los ancianos decrépitos, derraman lágrimas con facilidad y abundancia. »

« También es propio del eunuco, como de las mujeres y los niños, la afición a las ocupaciones frívolas, como el juego con las aves y cosas semejantes. »

« Otro efecto de la castración es la voracidad excesiva al comer y la codicia y mezquindad en guardar los manjares para sí, lo mismo que lo hacen los niños.... »

[62] « Otro efecto es la prontitud con que se irritan y se aplacan a continuación, que es también condición peculiar de los niños y de las mujeres. »

« Otro efecto es el gusto por la maledicencia y la chismografía, y la falta de fidelidad en guardar un secreto, igual que les pasa a las mujeres y a los niños. »

« Otro es la afición, que también es propia de las mujeres, a quitar y poner los muebles, a barrer y regar la casa, a sacudir y extender los tapices, y en general, la paciencia para todas las faenas del servicio doméstico. »

« También adquiere el eunuco gran resistencia para montar a caballo y energía para sostenerse mucho tiempo galopando, hasta aventajar en esto a los jinetes turcos y a los mejores caballeros de los *Khârijites*. Cuando su amo le entrega su caballo al eunuco para que se lo guarde mientras él entra en la mezquita a la oración o a la casa de baños para lavarse o a visitar a un amigo que está enfermo, no deja el eunuco de montar el caballo de su amo y hacerlo correr, yendo y viniendo, hasta que el amo regresa. »

« También posee el eunuco gran afición al tiro de flecha, como un efecto de su amor a la guerra contra los bizantinos. » (15)

« Prefiere asimismo el eunuco ser esclavo de los príncipes, aunque no le den más salario que la manutención, antes que servir a gentes de inferior clase social, aunque éstas le den trato principesco. »

« Lo admirable es que los eunucos, estando como están al margen de la complexión natural masculina y tan próximos al temperamento de las hembras, no les sobrevenga, a pesar de todo, el vicio de la inversión sexual. Porque yo he visto más de un árabe beduino, afeminado e invertido, que daba rienda suelta a su libertinaje, como también he visto gran número de locos invertidos, aun entre los etíopes de pura raza y hasta de un kurdo me contaron que lo era; pero jamás ví un solo eunuco afeminado, ni a mis oidos llegó munca la noticia de alguien que lo fuese. No sé cómo es así, ni cuál sea el obstáculo que se les impida; pero el hecho es de evidencia palmaria y parece que tiene que ser ley general..... »

« Muchos ancianos que alcanzaron largos años de vida y muchos observadores expertos y discretos afirman que, después de estudiar atentamente la duración de la vida en varias categorías de personas, encontraron que los eunucos longevos eran en mayor número que los longevos de cualesquiera otras categorías de hombres, dotados de virilidad, y que, comparadas las vidas de los eunucos con las de sus mismos hermanos y primos no castrados, observaron asimismo que la longevidad en aquéllos era ley general, mientras que en éstos apenas si por acaso se encontraba uno tan sólo u otro que alcanzase larga vida. Y añaden que, para esta longevidad de los eunucos, no creen encontrar otra causa, que la privación en ellos del coito y la menor efusión seminal, con el consiguiente menor desgaste de las energías medulares. Dicen, además : no encontramos, entre los animales que hacen vida doméstica con los hombres, es decir, caballos, camellos, asnos, bueyes, carneros, perros, gallinas, [64] pichones, gallos y pájaros, ninguno que tenga más larga vida que el mulo; asimismo, encontramos que los pájaros son los que menos larga

(15) En otro lugar, afectivamente, pondera JÂḤIẒ el odio mortal de los eunucos musulmanes contra los bizantinos, a quienes consideran como autores de su degradada condición.

vida alcanzan. Y esto es así, por el excesivo uso que del coito hacen los pájaros, mientras que el mulo hace de él muy poco uso. Hasta emplean estos observadores la longevidad del mulo, superior a la de sus padres, como prueba en contra de este dicho del vulgo : « nadie vive más que sus padres », si bien el vulgo, al decir esto, se refiere tan sólo al hombre y no a los demás animales. »

[72] « El accidente que con más frecuencia sobreviene a los eunucos es el de orinarse en el lecho y fuera de él, singularmente cuando se duermen repletos de bebidas alcohólicas, pues la afición a beber con exceso es también vicio que adquieren, después de castrados, lo mismo que la voracidad excesiva. »

[76] « El eunuco, a pesar de la amputación del miembro viril, contrae nupcias y toma esclavas concubinas y siente intensa pasión por las mujeres, lo mismo que las mujeres por él. Y es que, no obstante la castración, quédale todavía lo que quizá gusta más a las mujeres. En sueños y en el coito emite un cierto líquido, pero en pequeña cantidad, claro, flojo y de olor alterado..... La efusión de este líquido no le impide reiterar el coito, [77] precisamente porque su exigua cantidad no le debilita, como debilita al hombre no castrado la efusión del licor seminal, que es más denso, más abundante, de olor más penetrante y de naturaleza más pura..... »

[79] « A causa del intenso amor que los eunucos tienen a las mujeres, unido a la pena y tristeza que sienten por verse privados de ellas, odian a los machos con rencor más vivo que el que se tienen los enemigos más encarnizados, hasta un extremo tal, [80] que su odio es incomparablemente mayor que el que siente el envidioso respecto del envidiado, o el peatón al jinete, o los príncipes arruinados a los pobres enriquecidos, o el que se tienen los primos reñidos o los vecinos que ejercen en competencia un mismo arte u oficio. »

(Universidad de Madrid) MIGUEL ASIN PALACIOS.

The "Book of Treasure", an early Arabic Treatise on Medicine

When Greek medical science had come to a standstill, after the death of the great GALEN, (c. 200 A. D.), Hellenistic and, later on, Syriac authors wrote encyclopedias and compendiums of medicine, all of which were based on the works of GALEN and his predecessors. We possess several of the Greek encyclopedias by ORIBASIOS, AËTIOS OF AMIDA, ALEXANDER OF TRALLES and PAUL OF AEGINA (1). But of the Syriac productions there is nothing left, with the exception of an anonymous medical treatise published by BUDGE (2). Moreover, the memory of the most famous of these treatises has been perpetuated by numerous quotations in the *Continens* of RHAZES; it is the *Pandectae Medicinae* by AHRÔN (AARON), a Christian priest and archiater of Alexandria in the first half of the VIIth century A. D., a treatise in thirty books, which was early translated from Syriac into Arabic.

It served as a model to the Arabs, and from it or similar works which bear in Syriac the name of *kenâshâ* (i.e. collection) the Arabian physicians called their compendiums *kunnâsh* (plural *kanânîsh*). Many such « medical pandects » were written, from 750 A.D. onwards, by the Christian (Nestorian) physicians of Gondê-Shâpûr in Persia and Baghdâd, during the reigns of the first twenty Abbasid caliphs. But nearly all this great scientific

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(1) See GEORGE SARTON, *Introduction to the History of Science*, vol. I, Baltimore, 1927.

(2) E. A. WALLIS BUDGE, *Syrian Anatomy, Pathology and Therapeutics*, etc. 2 vols. London, New York, etc. 1927. Additions and corrections by C. BROCKELMANN in *Zeitschr. d. Deutsch. Morgenländ. Gesellsch.*, 68, 185-203, 1914; and by J. SCHLEIFER, *Zum syrischen Medizinbuch*, in *Zeitschr. f. Semitistik u. verw. Gebiete*, Vol. 4-6 (1926-8) (to be continued).

output is lost in its original form, and only a few such books are extant in manuscripts in various libraries. So far none of them has been published in print. (3)

It was some years ago that Dr. GORGY SOBHY, Assistant Professor of Medicine and Professor of the Coptic end Demotic languages at the Egyptian University, discovered in the Patriarchal Library in Cairo a MS. of such a ***kunnâsh***. He was encouraged by Prof. 'ALÎ BEY IBRÂHÎM, now Vice-Rector of the University and Dean of the Medical Faculty, and by myself to undertake its publication on the occasion of the Centenary Celebration of the School of Medicine, in December 1928. Dr. SOBHY published the Arabic text of the MS. splendidly printed, with a medico-historical introduction in English and a most useful glossary of the technical terms (4). The great hurry in which this edition had to be completed is responsible for a series of misprints besides some mutilations of Greek and Syriac words occurring in the text. It is an invaluable publication of one of the early Arabic medical compendiums and, for this reason, I intend giving hereafter a detailed analysis of this book in order to render its contents accessible to the historians of medicine and science.

The title is : « The Book of Treasure (or Treasury) in the Science of Medicine » *(Kitâb adh-Dhakhîra fî 'Ilm aṭ - Ṭibb)* composed by THÂBIT IBN QURRA. The preface states : « He compiled it during his life for the benefit of his son SINÂN IBN THÂBIT IBN QURRA ». So it must be the work of one of the greatest Arabic scholars that ever lived, one of those astonishing polymathists of Islamic civilisation, at one and the same time physicist, mathematician, astronomer, physician and translator from Greek and Syriac into Arabic. Though we must question the accuracy of ascribing its authorship to THÂBIT, I fully agree with Dr. SOBHY's

(3) Since I wrote the above line another Arabic *pandect* of still greater importance has been published in print : *Firdawsu'l-Ḥikmat* or *Paradise of Wisdom*, by 'ALÎ B. RABBAN AṬ-ṬABARÎ (ed. by M. Z. ṢIDDÎQÎ, Berlin, 1929), written in 850 A. D. See E. G. BROWNE : *Arabian medicine*, Cambridge, 1921, pp. 37-44; G. SARTON, *Introduction*, I, 574-5.

(4) See analysis in *Isis*, 13, 364 *The Book of the Dakhira* edited by Dr. G. SOBHY. Cairo, Government Press, 1928. Lex. 8, 15-43-186 pp. and three plates. Some corrections and explanations of Greek, Syriac and Sanscrit terms are given by HERMANN LEHMANN in his short analysis of the book (*Orientalist. Literaturzeitung*, 32, 869-73, 1929.

conclusion that « the book is unique, old and interesting and, in every sense, merits publication ».

ABÛ'L-ḤASAN THÂBIT IBN QURRA IBN MARWÂN AL-ḤARRÂNÎ (c. 835-901 A.D) (5) was, as is evident from his name, a native of Ḥarrân in Mesopotamia, the chief seat of the Sabians (Sabaeans), a sect of star-worshippers who formed a heathen colony in the midst of Muslim territory. It was doubtless owing to their religion that the Sabians produced many prominent astronomers and mathematicians of whom THÂBIT and AL-BATTÂNÎ are the most renowned. Ḥarrân, mereover, became, during the reign of the caliph AL-MUTAWAKKIL (847-61 A.D.), the seat of the School of Philosophy and Medicine which had been previously transferred from Alexandria to Antioch and the Syriac speaking districts of the caliphs' reigns (6). THÂBIT B. QURRA, after a religious quarrel with his Sabian countrymen, left his birthplace Ḥarrân, gained a great reputation by his translations and his own scientific output and was introduced by the astronomer and statesman MUḤAMMAD B. MÛSÂ to the court of the Abbassid caliphs in Baghdâd. Here he became the personal friend and table-companion of the caliph AL-MU'TAḌID (892-902) in whose service he died.

His mathematical, astronomical, physical and meteorological works, not to mention those on music, geography, botany and agriculture, are world-famed. Less is known about THÂBIT's medical skill and literary activity. He is much praised by the Arabic chroniclers as an excellent practitioner. Among the some two hundred works mentioned as his by the bibliographies, about forty deal with medicine. The « Treasure of Medicine » is not mentioned by the earliest biographer IBN AN-NADÎM (Xth century), but by SHAMS AD-DÎN MUḤAMMAD B. MAḤMÛD ASH-SHAH-

(5) The best accounts of his life and work taken from Arabic sources are contained in : D. CHWOLSON, *Die Ssabier und der Ssabismus*, Petersburg 1856. vol. I, pp. 546-67. L. LECLERC, *Histoire de la médecine arabe*, Paris 1876, vol. I, pp. 168-172; H. SUTER, *Die Mathematiker und Astronomen der Araber*, Leipzig 1900, pp. 34-38; E. WIEDEMANN, *Ueber Thâbit ben Qurra, sein Leben und Wirken* in *Beiträge zur Geschichte der Naturwissenschaften*, LXIV, Erlangen 1921; G. SOBHY *The Book of the Dakhira* p. X-XII; J. RUSKA in *Encyclopaedia of Islam*, vol. IV, p. 733; and G. SARTON, *Introduction to the History of Science*, vol. I, p. 599-600; the two last named give a complete bibliography.

(6) M. MEYERHOF, Von Alexandrien nach Baghdad, ein Beitrag etc. *In Abhandlungen der Preuss. Akademie d. Wissenschaften*, Berlin, 1930.

RAZÛRÎ AL-ISHRÂQÎ (lived c. 1200 A.D.) who summarised an older history of philosophers and physicians (7). He says : « THÂBIT created a work *The Book of Treasure;* it is precious for the medical art ». IBN AL-QIFṬÎ (d. 1248) who gives, in his « History of Philosophers », a biography of THÂBIT accompanied by a bibliography of THÂBIT's writings by his great-grandson AL-MUḤASSIN B. IBRÂHÎM B. HILÂL AṢ-ṢÂBÎ'(8), writes as follows : « In the hands of the people is an excellent Arabic *kunnâsh* known as *The Treasure* ascribed to THÂBIT and an Arabic Missive containing a Commentary on the sect of the Sabians. I (viz. IBN HILÂL) asked ABÛ'L-ḤASAN THÂBIT B. SINÂN B. THÂBIT B. QURRA (9) about this missive and the *kunnâsh* and he said : they are not by THÂBIT, for I did not find them either among his books or in his registers ». On the other hand IBN ABÎ UṢAIBI'A says in his *Classes of Physicians* (10) : « His book known as *The Treasure* which he composed for his son SINÂN B. THÂBIT ». And in the introduction of the Cairo MS. the copyist, as mentioned above, writes : « He compiled it during his life-time for the benefit of his son SINÂN B. THÂBIT B. QURRA ». As this same SINÂN denies the authenticity of the work claimed to have been written for him by his father, the decision must be left to the philologists; they will have to decide whether the style of the *Treasure-Book* corresponds to that of THÂBIT's other Arabic writings or not (11). Anyhow the book already existed in the middle of the Xth century and is, together with my own edition

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(7) His works exist only in three Mss. (Berlin *Mo* 217 and *Landb.* 430, and Leiden Catalogue III, p. 343). The passage concerning THÂBIT has been summarised by E. WIEDEMANN (*Beiträge* XX, p. 63-65).

(8) *Tarîh al-Ḥukamâ'* ed. I. LIPPERT, Leipzig 1903, p. 115-122.

(9) He was the brother-in-law of THÂBIT B. SINÂN and the son of IBRÂHÎM B. HILÂL AS-ṢÂBÎ', moreover the father of HILÂL B. AL-MUḤASSIN, all three well known secretaries and historians in Baghdâd during the period from c. 930 to c. 1050 A.D. See *Encyclopaedia of Islâm* vol. IV. 1924, p. 19 foll.

(10) *'Uyûn al-anbâ' fî ṭabaqât al-aṭibbâ'*, Cairo 1882 vol. I, p. 219, line 6.

(11) I myself have stated that another medical book ascribed to THÂBIT is spurious. (C. PRUEFER and M. MEYERHOF, *Die angebliche Augenheilkunde des Thâbit b. Qurra*, in *Centralblatt f. Augenheilkunde* vol. 35, 1911). I possess, moreover, copies of another ophthalmology ascribed to the great translator ḤUNAIN B. ISḤÂQ and supposed to have been composed for his sons. But Professor BERGSTRÄSSER's philological examination showed the book to be a compilation made, probably, by ḤUNAIN's disciples.

of ḤUNAIN's great ophthalmological treatise (12) the earliest specimen of that type of Arabic scientific literature hitherto published.

I found another proof of the great age of THÂBIT's *Treasure-Book* in the numerous quotations from it in a yet unpublished medical treatise ascribed to the most celebrated Arabo-Persian physician AR-RÂZÎ (RHAZES). This is *The precious Book on Medicine (al-kitâb al-fâkhir fî't-ṭibb)* existing in a MS. (Or. 91) at Leiden. IBN ABÎ UṢAIBI'A (I, p. 318) considers that this treatise is not the work of RHAZES but compiled by his disciples from another medical encyclopedia *(Kitâb at-taqsîm w'at-tashjîr)* composed by him. Anyhow it contains mostly quotations from the *kunnâsh* of YÛḤANNÂ B. SARÂBIYÛN (JOANNES SERAPION) a Christian practitioner of the IXth century, and from THÂBIT's *Dhakhîra*. The author quotes it simply with the word : THÂBIT. A section of this treatise, that on stones in kidneys and bladder, is printed and offers to Oriental scholars the possibility of comparison between the two texts (13). I myself collated the ophthalmological section of the *Precious Book* of which I possess a photostatic copy, thanks to the kindness of my friend Dr. C. VAN ARENDONK, curator of the Leiden Oriental Library. I collated, moreover, the text of the *Dhakhîra* with the quotations from THÂBIT in the *Kitâb ash-shamsiyya al-manṣûriyya* by ABÛ MANSÛR AL-ḤASAN B. NÛḤ AL-QUMRÎ, a Persian physician of the Xth century and one of the teachers of the great IBN SÎNÂ (AVICENNA) (14). But these quotations are not identical with the text of the *Dhakhîra* and must have been taken from another medical book by THÂBIT now lost.

The Cairo MS. of the *Dhakhîra* comprises 383 pages of 25 lines each, written in a fairly clear handwriting dated from Saturday the 7th Jumâda al-Awwal A.H. 607, i.e. 28th Oct. 1210 A.D. Thus it was copied some 300 years after the death of the supposed author. The copyist was a Muslim, probably Egyptian.

(12) *The Book of the Ten Treatises on the Eye ascribed to Ḥunain b. Isḥâq*, ed. by M. MEYERHOF, Cairo 1928. (*Isis*, 13, 106-09).

(13) *Traité sur le calcul dans les reins et dans la vessie par* ABÛ BEKR MUḤAMMED IBN ZAKARÎJÂ AL-RÂZÎ, ed. P. DE KONING. Leyde 1896, p. 79-91. This passage corresponds to the pp. 107-8 of SOBHY's edition of the *Dhakhîra*. See *infra* chapter 17.

(14) A Ms. is in the National Library in Cairo under *No.* 476 *Medicine.*

The MS. is in such a good state of preservation that it was possible for Dr. SOBHY to make a very convenient edition of it.

The « *Book of Treasure* » is, as stated above, the prototype of a medical *kunnâsh* (collection, compilation, pandect) of which hundreds were written, but of which, as also stated above, none exists in a printed Arabic edition. It is a form of short compendium, much shorter than the great encyclopedias of AVICENNA and ABÛ'L-'ABBÂS, dealing with the diseases of the human body from top to toe (15). The main part of such books is usually preceded by some chapters on anatomy, physiology or hygiene and followed by others on infectious diseases, poisons or remedies. These « pandects » are generally compilations from old medical authors with additions from the personal experience of the writer. So it is with our present book; I will now give an analysis of its contents, adding transliterations of medical terms, since many of them are missing from the dictionaries and from Dr. SOBHY's glossary.

CONTENTS OF THE BOOK.

After a short introduction in which it is stated that the *Book of Treasure* was composed by « the Master of his Time » THÂBIT IBN QURRA for his son SINÂN, there follows an Index of the 31 chapters which we omit.

Chapter 1 : *General consideration on the preservation of health.*

This is a series of quotations mainly from HIPPOCRATES' *Aphorisms* with GALEN's commentary and from the latter's *De sanitate tuenda*. It begins with an explanation of the origin of man from blood and sperm, of the origin of innate heat, of the faculties of the aliments and their excretion. Damage is caused chiefly by bad regulation of life, over-nutrition, lack of exercise. Enumeration of the kinds of meat, of the qualities of the aliments (according to GALEN, *De alimentor. facult.*), drinks (according to HIPPOCRATES *De diaeta acutorum* and the Arabic philosopher and physician AL-KINDÎ). Advantages of vegetable diet. Danger of mixing fat and oily things with sour pickles and raw fruits. The last

(15) RHAZES calls this with alliteration *min al-qarn ilâ 'l-qadam (a capite ad calcem)*; other Arabic authors call it *min al-qaḥf ilâ 'l-qadam* (same sense).

sentences of this chapter are of particular interest and I therefore give them in translation :

« What they (the Ancients) recommended is abstinence from intercourse with people who are suffering from contagious diseases which are in general seven : leprosy, scabies, small-pox (16),measles, ozaena *(bakhr)*, ophthalmia and the pestilential diseases. Moreover to beware of diseases which are hereditary from the parents, and which are also in general seven : leprosy, vitiligo, consumption *(diqq)*, phthisis, melancholy, gout and epilepsy. And he who is inclined to plethora must diminish the quantity and quality of his nutrition, or one of the two, and increase exercise ».

Chapter 2 : *Remarks on hidden Diseases in the similar and organic Parts of the Body* (17).

In this short chapter, after having quoted GALEN's *Methodus medendi* THÂBIT gives his own opinion on the diagnosis of « hidden » diseases. They are to be known, when general, by the colour and odour of the urine and perspiration. When local they are to be recognised by the colour of the diseased part and by its becoming heated when massage with dry hands or rough towels is applied to the painful spot.

Chapter 3 : *On Skin-diseases of the Head.*

« On the preservation of the hair in its natural condition ». Many recipes for hair-lotions and salves, some taken from GALEN's *De compositione medicamentor. sec. locos* (18). There follows an exposition of the causes of loss of hair, based on GALEN's *De temperamentis ;* next come methods of making the hair fall, among them the well known arsenical depilatory *(nûra)*. Many recipes, such as those compounded with hemlock (*shûkrân*, Conium maculatum) and opium, are given as being efficacious but very dangerous.

Alopecy (*dâ'ath-tha'lab*, i.e. fox's disease); bald places on the

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(16) See chapter 26. The mention of small-pox proves that THÂBIT did not summarise this from ancient Greek authors but from late Hellenistic and early Arabic treatises.

(17) Following GALEN (e.g. *De facult. nat.* I, 6) : ὁμοιομερῆ μόρια i.e. composed of similar parts throughout, homogeneous; this refers to the elementary tissues. And σύνθετα or ὀργανικὰ μόρια, compound organs, i.e. composed of different tissues.

(18) This book of GALEN is generally known to the Arabs by the na ofme *mayâmir*, a plural formed from the Syriac word *mêmrâ* i.e. sermon.

head (*dâ'al-ḥayya* i.e. snake's disease, ὀφίασις) and ordinary baldness (*ṣal*^{t}). The last mentioned is, according to GALEN, to be considered as incurable, although GALEN himself saw an isolated case healed by the ἱερά-remedy of RUFUS (I, cap. 1). The other kinds are treated with embrocations, friction of the too smooth skin with borax or the rough skin of a fish and anointment with oil, wine, clay etc. A diet is prescribed.

Lichen (*ḥazâz*) sometimes causing excoriation (*sa'fa*). Treated with extracts of flowers (mallow) and compresses of flour.

Lice (*qaml*), crabs (*qimqâm*, phthirii) and nits (*ṣîbân*) are generated by concentration of the sweat in the deep layers of the skin. Treatment by baths and strongly acrid remedies.

Excoriations (*sa'fa*) (19), dry or wet, frequent in children and plethoric patients. Treatment by blood-letting, sternutatories and local applications.

Chapter 4 : *Diseases of the Skin of the Face.*

« The diseases occurring on the surface of the skin of the face, such as pigmented spots (*kalaf*, xanthelasma), eczema (*qawâbî*), black and white scars from scratches (*ḥadash*) and ulcers; on cupping at the neck, the prompt rooting out of warts (*thâ'lîl*) and pimples (*'adasiyyât*); on recipes for washes and lotions and what cleans the epidermis and spreads out the skin and checks shrinking.... freckles (*barsh wa-namsh*, lentigines), and marks (*khayalân*) on the face ». Mostly recipes, some taken from GALEN's *De comp. medicam.* ; they sometimes resemble the cosmetics of to-day (powders and flours of different cereals and Leguminosae). A remark on the ordinary occurrence of pigmentation of the skin (*kalaf*) in pregnant women is of interest.

Chapter 5 : *On the Kinds of Headache.*

Exposition on the pulse in cases of severe headache; it is called « the great and complete in length, breadth and depth ». Other external symptoms are redness of the face, swelling of the blood-vessels, roughness in the throat and a sweet taste in the mouth. Discussion of the different kinds of headache; that which is caused by the yellow gall, e.g. is the consequence of sorrow, wrath, fasting, watching, irregularity of meals. Many recipes from GALEN and others and dietetical measures (avoidance of fish, fowl, fat and wine).

(19) It is perhaps the disease which we call to-day *favus*.

The hemicrania *(shaqîqa)* is explained by the flowing of noxious residues to the right or left half of the brain. There follows a quotation from Galen's lost commentary on the medical sayings in PLATO's *Timaeus*.

Chapter 6 : *On apoplexy (sakta), palsy (fâlij, i.e. hemiplegia, πληγή), facial paralysis (laqwa), spasm (tashannuj) from moist and dry temper, numbness (khadar), falling sickness (ṣar'), tremor (ri'sha) and « the rheums of gibbosity » (riyâh al-afrasa), i.e. the humpbackedness (ḥadab)* (20).

Explanation of the supposed causes of these diseases, partly following GALEN. Good observations on respiration : if it is difficult and stertorous this is a sign ot the severity of the attack. Remarks of HIPPOCRATES on the age at which apoplexy occurs (from fifty upwards). Treatment according to GALEN and YÛḤANNÂ B. MÂSAWAIH (died 857 A.D.). Record of spasms, especially in children, partly according to HIPPOCRATES and GALEN *(Ad Glauconem)*. Chronic tremor may be caused by a « pressure on the animal spirit » by fright and similar psychical accidents. The « rheums of gibbosity » may be provoked by external trauma or by an internal abscess on the backbone.

Chapter 7 : *On melancholy (mâlankhûliyâ), epilepsy* (21), *syncope (sadad), vertigo (dawâr, giddiness), lethargy (subât) from heat or cold, lethargy with insomnia (subât saharî) and nightmare (kâbûs)*.

Many quotations from GALEN, one from his commentary to Timaeus.

Chapter 8 : *Eye-diseases*.

After a short anatomy of the eye follows a paragraph on ophthalmia *(ramad)* and its treatment according to GALEN *(Meth. medendi)* and THÂBIT's own experience. Then follow leucoma *(bayâḍ)*, pterygium *(ẓafara)*, trachoma (*ṣarab*, i.e. literally « scab ») and pannus *(sabal)*; the last two diseases are treated

(20) The idea is that the « winds » or rheums *(riyâḥ)*—which we to-day call tuberculosis—break the bones of the vertebral column and cause gibbosity with paralysis of the spinal cord.

(21) The Arab physicians mostly designate spasmodic epilepsy by the Arabic word *ṣar'* (which I rendered by « falling sickness »), the psychical form by the Greek word (*âbûlîbsiyâ, ἐπιληψία*).

together and in the same manner. The operation for peritomy of the pannus *(laqṭ)* is mentioned. Ulcerous blepharitis *(sulâq)*, contusions of the eye-ball by fall and blow, nightblindness *('ashâ')* and cataract (*mâ'*, i.e. « water »). The method of examination of the pupils, in order to ascertain the possibility or impossibility of an operation for cataract, is mentioned. Then follows the treatment for amblyopia (*ẓulmat al baṣar*, dimness of sight) following IBN MÂSAWAIH's *Daghal al-'ain*, the earliest existing Arabic treatise on ophthalmology; lachrymal fistula *(gharab)*, proptosis *(natw)* and exophthalmus *(juḥûẓ)*, trichiasis *(sha'r munqalab)*, falling out of the lashes *(intithâr al ashfâr, hudub)* and phthiriasis *(qaml)* of the lids. The treatment is along the lines laid down by ḤUNAIN B. ISḤÂQ (22).

Chapter 9 : *Diseases of the Ear.*

A short chapter on otorrhoea *(sayalân al-midda)*, deafness *(ṭarash)* and penetration of water into the ear. Treatment mostly according to GALEN *(De comp. med.)*.

Chapter 10 : *Diseases of the Nose.*

Introduction by a quotation from GALEN *(Timaeus)* on odours. Reasons for disappearance of the sense of smell *(ibṭâl ash-shamm)*, haemorrhage *(ru'âf)*, variation of the sense of smell and « haemorrhoids » *(bawâsîr)* i.e. repeated haemorrhage and polypi in the nose.

Chapter 11 : *Diseases of the Mouth.*

Fissures of the lips *(shiqâq ash-shiffa)*, glanders (*qilâ'*, pustules) and their different kinds, swelling and palsy of the tongue, pain, caries and discoloration of the teeth, slackness and fistula of the gums *(luththa)*, ozaena *(bakhr)*, falling off of the uvula *(suqûṭ al-lahâh)*, croup or diphtheria *(khawânîq)* of the tonsils, leeches *('alaq)* in the throat—of somewhat frequent occurrence in Oriental lands—and the treatment of drowned people *(gharîq)*. It is remarkable that arsenic is recommended for decayed teeth.

Chapter 12 : *On Catarrhs (nazlât), Cough (su'âl), other diseases of Chest and Heart and Fluxion (sayalân) from the Head.*

« What flows down to the nostrils is called coryza *(zukâm)* and what is poured into the mouth is called catarrh *(nazla)* ; their

(22) See *The Ten Treatises on the Eye ascribed to Ḥunain b. Isḥâq*, ed. M. MEYERHOF, Cairo, 1928.

origin generally lies in the brain ». These diseases cause swellings in the brain, swellings of the tonsils and uvula and diseases of the chest, e.g. phthisis. Many recipes are given, among others poppy-juice for haemoptysis.

Asthma *(rabw)* is explained in accordance with THÂBIT's opinion and that of GALEN as being a formation of mucus in the respiratory tract, combined with weakness of the muscles of the thorax. Long theoretical exposition of other causes.

Hoarseness *(buḥḥa)*, pleurisy *(dhât al-janb)* and pneumonia *(dhât ar-ri'a)*. Description of the crisis after from four to fourteen days (HIPPOCR., *De morbis acutis*, GALEN *De locis affectis*) and of the treatment (GALEN, YÛḤANNÂ B. SARÂBIYÛN). Pain in the chest *(ḥazḥaza)* (23) often accompanies these diseases.

Haemoptysis *(nafth ad-damm)* and expectoration *(tanakhnukh wa-tanakhkhu')* are sometimes difficult to distinguish from vomiting of blood.

On voice, speech and their disturbances. Anatomical description of the Nervus recurrens and of the organs of speech. Causes of hoarse voice, etc. and its treatment.

On phthisis : « This disease occurs mostly in bodies which are from their original structure predisposed to develop it; they are those whose thoraxes are naturally narrow and whose shoulder-blades are prominent and destitute of flesh — which are called wing-shaped *(mujanniḥûn)* — whose necks are long and larynxes prominent.... This disease sometimes originates in pleurisy, pneumonia and swellings in the thorax, diaphragm and in the lungs. » A milkdiet is largely recommended except in the case of feverish patients where a barley-decoction is to be given. All fatigue is to be avoided by sufferers from consumption.

On heart-diseases : They are characterised by palpitation, caused by repletion of the heart with blood or by swelling of the pericardium. If inflammatory, they cause sudden death. If the swellings are thick, they provoke disturbance of the heart *(ghuthâ qalbî)* and dropsy of the pericardium *(rutûba muḥtabasa fi'l-ghishâ' al-muḥîṭ bi'l-qalb)*. Among the remedies Cucurbita-

(23) This word is missing in the glossary and in the European dictionaries. *Lisân al-'Arab* ed. Cairo VII, p. 200 says : *ḥazz, ḥazâza, ḥuzzâz* or *ḥazḥaza* is a cutting or rubbing pain in the heart or chest.

ceae predominate as diuretics and a wax-plaster called *qîrûṭî* (*κηρωτή*).

Chapter 13 : *Diseases of the Stomach.*

Introduction in the anatomy of the stomach, mostly according to GALEN; mention of the nerves near the cardia and the muscular tunics of the fundus. Prescriptions for indigestion caused by hot or cold temperament, in particular one composed by the Indian MANKA (who enjoyed a great reputation among the Arabs and was for some time physician in ordinary to the caliph HÂRÛN AR-RASHÎD). This prescription bears the name of the JÂVIDÂNÎ composition and is composed of a great many drugs, mostly Indian, Chinese and Persian ones; it consisted originally of 199 drugs which are enumerated in the *Aqrâbâdhîn* (i.e. *γραφίδιον*, a Syro-Arabic name for pharmacopoeia) of BADR AD-DÎN AL-QALÂNISÎ (quotation in a note by Dr. G. SOBHY).

Enumeration of different symptoms : throbbing *(khafaqân)*, flatulence *(nufkha)*, hiccup *(fawâq)*, canine appetite *(shahwa kalbiyya, qaṭṭâ)*, loss of appetite, nausea *(tahwî')*, vomiting *(qayy)*, eructations *(jashâ')*, colics *(maghaṣ)* and appetite for and eating of clay. Quoted are GALEN's theories on the genesis and the treatment of severe vomiting *(Meth. Med.)*.

Chapter 14 : *On Colics (qaulanj, κωλική) and intestinal Worms (dîdân).*

After a short anatomy of the intestines, description of four different kinds of colics. Many recipes, some of them quoted from ḤUNAIN B. ISḤÂQ.

The symptoms of ileus (*îlâûs, εἰλεός*), stercoraceous vomiting due to intestinal obstruction (24), are well described.

Among worms are mentioned tape-worms *(ḥayyât)* and « pumpkin-grains » *(ḥabb al-qar')*, probably the proglottides of taenia. THÂBIT explains their « spontaneous » generation in the intestines from putrified aliments.

Chapter 15 : *Diarrhoea (ikhtilâf, is-hâl) and dysentery (haiḍa, saḥj).*

Many recipes and diets, according to ḤUNAIN, IBN MÂSAWAIH and others.

(24) The Greek word *εἰλεός* is explained by the translation : « Lord, be merciful! » *(rabb irḥam !)*. From this, I suppose, is derived the mediaeval expression *Miserere* applied to this disease.

Chapter 16 : *Diseases of the Liver and Spleen, Jaundice, Dropsy, Diaphoretics, etc.*

Partly according to GALEN; prescriptions, among them one ascribed to THIYÂDHÛQ (THEODOKOS? THEODOTOS?), a practitioner of the early Islamic period (25).

Jaundice *(yaraqân)* is considered by THÂBIT, in accordance with GALEN, as a protection of the body by a kind of crisis, particularly for poisoned people. Discourse on the normal action of the gall. Jaundice accompanied by hepatitis, if observed in feverish diseases, is a dangerous symptom before the seventh day, a good one after the fourteenth (the crisis). Diagnosis of icteric urine; treatment mostly by laxatives.

Dropsy *(istisqâ')* is often caused by a disease of the liver; frothy expectoration is a symptom of bad prognosis. Different kinds : fleshy *(laḥmî)* dropsy in women accompanied by retention of the menses and diseases of the uterus; the tympanic form (*ṭablî*, pot-belly) had already been described by HIPPOCRATES and GALEN. Treatment by diet, particularly fruits, and diuretics (one recipe according to YÛSUF AS-SÂHIR, a contemporary of ḤUNAIN in the IXth century A.D.). This chapter concludes with a paragraph on diaphoretics.

Chapter 17 : *On Diseases of the Kidneys, the Bladder, the male Genitals (madhâkîr) and the Anus (muqâ'da).*

Generation of stones by condensing aliments (HIPPOCRATES, *De aere, locis etc.*), not only in the uropoietic system but also in the liver, caecum, colon and in the joints. Protection from stones by diet and diuresis. A superstitious remedy mentioned by GALEN is remembered : the wearing of iron rings and nails to prevent the formation of stones ! (26).

There follows a section on polyuria *(durûr al-bawl)* and retention *(asr)* of the urine. Diabetes is designated as a variety of the first-named and considered as a disease of the kidneys. Stillicidium *(taqṭîr)* and haematuria *(bawl ad-damm)* are explained

(25) He is said to have been physician to the great Umayyad statesman ḤAJJÂJ B. YÛSUF (661-714). He enjoyed the full confidence of this cruel and much feared vizier. IBN ABÎ UṢAIBI'A relates at some length anecdotes and sayings of THIYÂDHÛQ (I, p. 121-22, LECLERC I, p. 82 foll).

(26) The foregoing section is available to those who are interested in Graeco-Arabic pharmacopoeia in DE KONING's translation (*Traité sur le calcul dans les reins et dans la vessie*, Leyde 1896, pp. 79-91).

as being caused by weakness of the kidneys or a varicocele in one of them, pyoid urine *(bawl al-midda)* by ulcers in the uropoietic system.

After a short discourse on swellings and tumours in the genital organs THÂBIT discusses the different kinds of hernia *(qail*, κήλη), hydrocele *(qailat al-mâ')* and aerocele *(qailat ar-rîḥ)* and at the end haemorrhage from the anus, haemorrhoids *(bawâsîr)*, fistula *(nâṣûr)* and fissures.

Many pages full of prescriptions complete this chapter.

Chapter 18 : *On female Diseases and the Treatment of Obesity (simna).*

Atresia of the uterus *(ikhtinâq al-arḥâm)*, misplacements of the uterus and disturbances of the menses are discussed. Among the remedies the ἱερά *(ayârij)* of the famous Alexandrian RUFUS and the Barmecid pastiles *(qurṣ, iqrâṣ al-Barmakî)* are remarkable; the latter were probably named after one of the members of the family of powerful viziers who lived in the second half of the VIIIth century at Baghdâd; or it may have been prescribed for their harem by one of the court-physicians bearing the name of AL-BARMAKÎ.

A very important paragraph for Orientals is that on the causes of pregnancy and sterility. The doctrine of dry and wet tempers plays an important rôle here. A very original proof of sterility is related : — a proof still in use in some Western and Oriental lands : — husband and wife have to urinate on young pumpkin or lettuce plants; if one of these becomes dry, it convicts the author of the sterility !

Tumours of the uterus *(rijâ')* (27) may provoke the same symptoms as pregnancy and lead to ascites. Difficult birth, miscarriage, diseases of the teats, disturbances in lactation are mentioned briefly and followed by many prescriptions. At the end a paragraph on obesity in women likewise consists chiefly of descriptions of numerous pharmaceutic compounds.

Chapter 19 : *On Gout (niqris) and Sciatica ('irq an-nisâ').*

Gout is caused by excess in eating and drinking, inadequate food, sexual excesses and lack of exercise. All these cause the flowing of residues *(faḍalât*, περιττώματα*)* into the joints of the

(27) Not to be found in the dictionaries.

hands and feet. The treatment consists correspondingly of vegetable diet, exercise and an enormous amount of « cleansing » remedies. Sciatica is caused by the flow of residues into the sciatic nerves. Local and general treatment.

Chapter 20 : *On Diseases of the Hands and Feet.*

Dracunculus (*'irq madînî*, i.e. Medina-worm, known to-day as Guinea-worm) is well described : « This disease occurs mostly in hot and sunburnt lands.... it appears mostly on the legs. When it appears on a limb, the latter first becomes hot and inflamed; then a spot becomes inflated (swollen), and the worm begins to come out ». Treatment by diet and remedies. « When it appears, it must be wound onto a tube of lead, as gently as possible. You must take care not to cut it, as it would stick (to the skin) and come out at another place..... »

The chief diseases of the nails are onychia *(dâḥis)* ; splitting up of the nails (*isnân al-fâr*, i.e. « teeth of mice »); fissures of the heels *(shiqâq al-'aqib)*, blisters *(aṭrâf)* in the hollow of the sole *(khaṣr)*, swellings caused by stumbling *('athra)*, warts *(tha'âlîl)*, callosities *('uqad)* and corns *(qurûn)* are described as diseases of the feet. Treatment with lotions and salves.

Chapter 21 : *General Diseases of the Skin.*

Description and causes, according to GALEN *(De locis affectis)*, of itch (*ḥikka*, *ψώρα*), scab *(jarab)* and erysipelas (Syriac : *mâsh-arâ*, Arabic : *ḥumra*). Treatment of moist ulcers *(qurûḥ)*, boils *(damâmil)* and abscesses *(khurâjât)* according to HIPPOCRATES; causes and treatment of small and large blotches *(sharâ)* and the prickly heat *(ḥasaf)* of hot lands.

Chapter 22 : *On Tumours, Swellings (awrâm) and Scalds (ḥirq).*

Long quotations from GALEN on tumours and swellings, partly following his *Ad Glauconem*, *Meth. Med.* Oedema (*οἴδημα*), scirrhus (*σκίῤῥος*; for both only Greek names), cancer (*saraṭân*, *καρκίνος*), scrofula *(khinzîr)*, hard tumours (*sal'*, *γαγγλίον*, probably fibroma), cystic tumours *(dubailât)*, viz. tallow-cysts (*dubaila shaḥmiyya*, *στεάτωμα*), honeycomb-cysts (*d.'asaliyya*, *μελικηρίς*) and pultaceous cysts (*d. aṣîdiyya*, *ἀθέρωμα*) and burns are explained and many remedies are mentioned.

Chapter 23 : *On Leprosy (judhâm, bahaq) and Vitiligo (baraṣ).*

The description of these diseases is not altogether clear; the

mutilating form of leprosy is mentioned. The Arabic *judhâm* corresponds to the Greek λέπρα, white and black *bahaq* to Greek ἀλφός (a mild leprosy or a kind of *tinea*?), *baraṣ* to Greek λεύκη. Etiology and therapy are described in accordance with GALEN *(Ad Glaucon)*.

Chapter 24 : *On Wounds and Contusions.*

Wounds in the head *(shijâj)*, ecchymosis *(qadhaf damm)*, and remedies to remove points of arrows *(zajj)* and thorns *(shawk)*. Only remedies, mostly salves and plasters.

Chapter 25 : *On Poisons (sumûm).*

Discourse on the different kinds of poisons : i〉 the bite of men and mad dogs; ii〉 that of snakes and adders; iii〉 stings of yellow *(jarârât)* and black scorpions *('aqrab)*, of hornets *(zunbûr)* and the mygale-spider *(ruthailâ)* ; iv〉 poisons which kill if used externally in very small doses, such as aconite *(bîsh)* and certain cobwebs *(ʾhalhal)* ; v〉 such as act by their smell, as, e.g. a certain kind of nard; vi〉 such as act when taken through the mouth; among these are mentioned parts of the nard « called *isrîq*, and their Arabic name is corns of nard *(qurûn as-sinbil)* ; they resemble the Cambodjian aloes-wood *('ûd Qamârî)* » (28).

Another strong poison is a mineral substance like coral (*bussadh*, Persian word), another one *kalâkût* (29) resembling the bulb of cyperus *(sʿd)*. vii〉 Poisons which act by decomposing the tissues of the human body; such are helleborus *(kharbaq)*, Spanish flies *(dharârîḥ)* (30) and the marine hare *(arnab baḥrî)* (31).

There follows a paragraph on the composition of poisons (mercury, ammoniac, belladonna, etc.), and then the description of the symptoms and treatment of the different kinds of poisonous bites and stings. Additions to the aforementioned are stings of the « vulturine louse » (Arabic : *qamlat an-nisr*, Syriac : *taimûkhâ*) (32),

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(28) *Isrîq* may be derived from Greek σήρικον, silk, or from Syriac *sirqâ* hook. Qamâr or Khmêr is the old name for Cambodja.

(29) This word is probably Persian; I was not able to find out its significance.

(30) In the printed text erroneously *darârîj*, i.e. heath-cock or francolin.

(31) Known to DIOSCURIDES and GALEN as λαγωὸς θαλάσσιος; it is *Aplysia depilans L.*, a harmless marine snail which was believed in ancient times and in the middle-ages to be poisonous, and to provoke the falling-out of the hair and hemorrhagic decomposition of the kidneys and liver.

(32) There is no mention of it in any of the pharmacological and zoological works of the Arabs. AD-DAMÎRÎ (XIVth century) only mentions a kind of small « winged lice », resembling small ticks; identification is still not possible.

and the bite of the mad wolf which is more dangerous than that of mad dogs.

In the following section THÂBIT discusses at some length the ways of counteracting poisons that have been drunk; he mentions cantharides *(dharârîḥ)*, litharge *(murdâsanj)*, arsenic *(zarnîkh)*, used as ratsbane and depilatory *nûra)*, belladonna (*lufféḥ*, i.e. mandragora-fruits), hyoscyamus *(banj)*, oleander *(diflâ)* (33), aromatics *('iṭr)* and mushrooms *(kamâh)* which cause suffocation; then a dry theriac (*tiryâq*, θηριακή) for all kinds of poisons, and remedies to drive away venomous insects *(hawâmm)* from rooms and houses; some of them are minerals, such as sulphur *(kibrît)*, others resins (pitch, *zift rûmî*) or vegetables (*bâdhâward*, i.e. ἄκανθα λευκή of DIOSCURIDES, a kind of thistle).

Chapter 26 : *On Fevers, Small-pox, Measles and Unconsciousness (fainting with or without Fever)*.

This is the longest chapter of all; its contents are partly taken from the ancient authors, partly they are of later date; Greek terms abound in it.

First GALEN's *Meth. Medendi* is quoted on fevers in general. Simple fevers are the ephemeral fever *(ḥummâ yawm)*, hectic fever (*ḥ. diqq)*, putrid fever *(ḥ.'afan)* which all have from three to ten subdivisions; tertian, quartan, phlegmatic and other fevers which are discussed in the following section. Of compound or complicated fevers more than thirty different varieties exist.

There follows a discussion of the causes and treatment of the different fevers. Hectic fever *(ḥummâ diqq)* (34) may become chronic and lead to marasmus *(dhubûl)*. Tertian ague *(ḥ. ghibb)* may be « complete », i.e. have an interval of 24 to 30 hours, or « incomplete » (*νόθος τριταῖος*) with an interval of 12 hours. Phrenitis *(sirsâm)* is accompanied by continuous fever, headache, redness of the eyes, dryness and roughness of the tongue and numbness. « Cold phrenitis » or *λήθαργος πυρετός* is not feverish but is accompanied by continuous yawning *(tathâ'ub)* and loss of memory *(nasayân)*. Caustic fever (*ḥummâ muḥriqa*, *καῦσος π.*) is an increased tertian; continuous fever (*ḥ. muṭbiqa*, *σύνοχος πυρετός*) is subdivided into three varieties. Quartan ague *(ḥ. rib')* makes

(33) The leaves of *Nerium Oleander L.* contain three different poisonous glycosids whose action on the heart is similar to that of digitalis.

(34) In the text copyist's blunder *aqṭîfûs* for *ἑκτικός*.

an attack of twenty-four hours and an interval of forty-eight hours duration. Mucous intermittent fever (*ḥ.nâ'iba balghamiyya*, *συνεχὴς φλεγματικὸς π.*) (35) is explained according to GALEN also semitertian ague (*ḥ.shaṭr al-ghibb*, *ἡμιτριταῖος π.*), the Greek name of which is formed by analogy with *ἡμίονος* (mule) (36). Fevers following swellings are putrid, when the putrefied blood from the affected limb reaches the heart.

Then follow paragraphs on crisis, pulse and urine according to GALEN.

The most important section of this chapter is that on small-pox and measles *(jadarî, ḥasba)*, since it seems to be prior to the famous classical description by RHAZES. Small-pox was unknown to the great Greek physicians and was probably first described by late Hellenistic or Syriac authors (37). Therefore I give a literal translation of the first half of this paragraph :

« Small-pox and Measles : The symptoms of these two diseases are an acute and continuous fever with fullness of the pulse, puffiness of the face, the temples and the jugular veins, roughness in the throat, a sweet taste in the mouth, lachrymation, discharge from the nose and severe aching in the joints and in the back. The malignant kinds of small-pox are the black, the green, the violet and next to these the yellow, and then the whitish livid (kind of eruption) which sometimes spreads and merges. The favourable kind is the red and round one, particularly when it appears on the third day and with diminution of the fever ». The treatment is general, for the fever, and local, particularly for the eyes, to protect them from the danger of eruptions on the cornea.

The chapter concludes with a discourse on fevers with unconsciousness *(ḥummayât ghashîiyya)* and unconsciousness in general, following GALEN's *Ad Glauconem*.

Chapter 27 : *On Plague (wabâ') and the local and climatic Conditions which provoke it.*

Following GALEN *De diff. febrium*. Distinction between deadly

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(35) The Arabic word *balgham* is a mutilation of the Greek *φλέγμα*. In the text is another title for this paragraph : *Fî durûr al-'izz*. This is perhaps a copyist's blunder for *durûr adh-dhanîn* (flow of mucus) or a similar name.

(36) The Greek words are completely defaced in the text.

(37) Perhaps by the priest and archiater AHRÔN of Alexandria. (See G. SARTON's *Introduction to the History of Science*, vol. I, p. 479).

pandemic *(mawtân)*, epidemic *(wâfida)* and endemic *(baladiyya)* diseases. Diet and remedies for prophylaxis.

Chapter 28 : *On Fractures (kasr), Luxations (khal*ʿ*), Distortions (saqaṭât) Dislocations (wuthâ) etc.*

General and pain-soothing treatment; emollients for sclerosis *(ṣalâba)* and callus *(dashbadh)* (38) after distortions and fractures.

Chapter 29 : *On Milk, Whey (mâ'al-jubn), sour Milk (laban labin) etc.*

Milk as a diet and remedy, its kinds and examination. Preparation of remedies with milk. Partly according to GALEN's *De sanitate tuenda.*

Chapter 30 : *On Wine (nabîdh) its Use and Abuse.*

Discussion of its qualities, kinds, utility, etc. Mostly according to GALEN *(De temperamentis, De sanit. tuenda, Methodus medendi, De alimentorum facultatibus)*, with quotations from HIPPOCRATES' *De diaeta acutorum.* Treatment of effects of intoxication *(khumâr)*. Appendix on water and its qualities.

Chapter 31 : *On sexual Intercourse (bâh).*

Causes and treatment of concupiscence and debility. The great number of prescriptions proves the importance of this theme for Oriental patients. The chapter and the whole book conclude with a paragraph on the treatment of pollutions *(imdhâ')* and with a contraceptional measure advised by the famous Arabic practitioner AL-ḤÂRITH B. KALADA, a contemporary of the prophet MUḤAMMAD.

Surgical diseases are mentioned in several chapters of the *Treasure Book*, but their treatment is purely medicinal. THÂBIT B. QURRA was a physician, and it is probable that in his time surgical treatment was mostly in the hands of low-class surgeons, bone-setters and barbers. The only class of medical men who enjoyed universal respect, although they performed operations, were the oculists *(kaḥḥâlûn)*. All the world-famed Arabic physicians, such as RHAZES, AVICENNA, AVERRHOES, AVENZOAR and MAIMONIDES abstained from surgical activity; the only exception seems to have been ABULCASIS.

I regret that lack of space prevents me from dealing with the

(38) This term is missing from the dictionaries; it may be derived from Persian *dushbîl* or *dashbil*, i.e. a callosity or scropula in the flesh.

most interesting pharmacopoeia of the *Dhakhîra*. Many rare drugs are mentioned with their Greek, Persian and sometimes Syriac names; several unknown compound preparations deserve investigation. (See H. LEHMANN's analysis mentioned in note 4).

In any case, scholars who intend to study the development of Greco-Arabic medicine will have to take into consideration the *Book of Treasure on Medicine* as being one of the earliest Arabic medical books composed by, or in the school of, THÂBIT IBN QURRA, one of the most eminent scientists of the Islamic world.

Cairo. MAX MEYERHOF

GLOSSARY OF ARABIC MEDICAL TERMS

(Entries refer to Numbers of Chapters).

âbîlibsiyâ, epilepsy 7
'adasiyât, pimples 4
'alaq, leeches 11
'aqrab, black scorpion 25
arnab baḥrî, Aplysia (marine snail) 25
'ashâ, nightblindness 8
asr al-bawl, retention of urine 17
'athra, swelling of the feet 20
aṭrâf (sing. *ṭaraf*), blisters 20
âyârij, hiera (purgative) 1, 18
bâh, sexual intercourse 31
bâdhaward, acantha-thistle 25
bahaq, lepra 23
bakhr, ozaena 1, 11
banj, hyoscyamus 25
baraṣ, white lepra, vitiligo 23
bawâsîr, hemorrhoids 17
» » in the nose 10
bawl ad-damm, haematuria 17
bawl al-midda, pyoid urine 17
bayâḍ, leucoma (of the cornea) 8
bîsh, aconite 25
buḥḥa, hoarseness 12
bussadh, (Persian) coral 25
dâ' al-ḥayya, exfoliation of the skin 3
da' ath-tha'lab, alopecy 3
dâḥis, onychia 20
damâmil (sing. *dummal*), boils 21
dashbadh (Persian *dashbil?*), callus 28
dîdân (sing. *dûd*), intestinal worms 14
diqq, consumption 1
dharârîh (sing. *dhurrâh*, *dhirrîḥ* etc.) Spanish flies, cantharides 25
dhât al-janb, pleurisy 12
dhât ar-ri'a, pneumonia 12
dhubûl, marasmus 26
difla, oleander 25
dubaila, cystic tumour 22
d. 'asaliyya, honeycomb-cyst 22
d. aṣîdiyya, pultaceous cyst 22
d. shaḥmiyya, tallow-cyst 22
durûr al-bawl, polyuria 17
fâlij, palsy, hemiplegia 6
fawâq, hiccup 13
gharab, lachrymal fistula 8
gharîq, drowned 11
al-ghishâ' al-muḥîṭ bi'l-qalb, pericardium 12
ghuthâ qalbî, cardial disease 12
ḥabb al-qar', taenia (proglott.) 14
ḥadab, humpbackedness 6
ḥadash, scratches 4
ḥaiḍa, dysentery 15
halhal, cobweb (?) 25
ḥaṣaf, prickly heat 21
ḥaṣba, measles 26
ḥawâmm, venomous insects 25
ḥayyât, tape-worms 14
ḥazâz, lichen 3
ḥazḥaza, pain in the chest 12
ḥikka, itch 21
ḥirq, burns and scalds 22

ḥummâ 'afan, putrid fever 26
ḥummâ diqq, hectic fever 26
ḥ. ghashiiyya, fever with unconsciousness 26
ḥummâ ghibb, tertian fever 26
ḥummâ muḥriqa, caustic fever 26
ḥummâ muṭbiqa, continuous fever 26
ḥ. nâ'iba balghamiyya, intermittent mucous fever 26
ḥummâ yawm, ephemeral fever 26
ḥ. shaṭr al-gihbb, semitertian fever 26
ḥumra, erysipelas 21
ibṭâl ash-shamm, disappearance of the sense of smell 10
ikhtilâf, diarrhoea 15
ikhtinâq al-arḥâm, atresia of the uterus 18
îlâûs, ileus 14
imdhâ', pollutions 31
intithâr al-ashfâr, i. al-hudub, falling out of the eyelashes 8
'irq an-nisâ', sciatica 19
'irq madînî, Guinea-worm 20
ishâl, diarrhoea 15
isnân al-fâr, splitting up of nails 20
isrîq, see *qurûn as-sinbil* 25
istisqâ', dropsy 16
istisqâ' laḥmî, fleshy dropsy 16
istisqâ' ṭablî, pot-belly 16
'iṭr aromatics 25
jadarî, smallpox 26
jarab, scab 21
jarab (al-ajfân), trachoma 8
jarâra, yellow scorpion 25
jashâ', eructations 13
judhâm, lepra 23
juḥûẓ, exophthalmus 8
kâbûs, nightmare 7
kalaf, xanthelasma 4
kamâ'a (sing. *kam'*), mushroom 25
kasr, fracture 28
khadar, numbness 6
hkafaqân al-mi'da, throbbing of the stomach 13
khal', luxation 28
kharbaq, helleborus 25
khaṣr, sole 20
khawâniq, croup, diphtheria 11
khayalân, marks on the face 4
khumâr, remains of intoxication 30
khurâj, abcess 21
khinzîr, scrofula 22
kibrît, sulphur 25
laban, milk 29
laban labin, sour milk 29
laqṭ, peritomy of corneal pannus 8
laqwa, facial paralysis 6
luffâḥ, mandragora-fruits 25
luththa, gums 11
mâ', cataract 8
mâ' al-jubn, whey 29
madhâkîr, male genitals 17
maghaṣ, colics 13
mâlankhûliyâ, melancholy 7
maraḍ baladî, endemic disease 27
maraḍ wâfid, epidemic 27
mâsharâ, see *ḥumra* 21
mawtân, pandemic 27
muqa'da, anus 17
murdâsanj, litharge 25
nabîdh, wine 30
nafth ad-damm, haemoptysis 12
namsh, freckles 4
nasayân, loss of memory 26
nâsûr, fistula 17
natw, proptosis (of the eyeball) 8
nazla, catarrh 12
niqris, gout 19
nufkha, flatulence 13
nûra, depilatory 3, 25
qadhaf damm, ecchymosis 24
qail, hernia 17
qailat al-mâ', hydrocele 17
qailat ar-rîḥ, aerocele 17
qaml, lice 3, 8
qamlat an-nisr, vulturine louse 25
qaṭṭâ, canine appetite 13
qawâbî (sing. *qûbâ*), eczema of the head, tetter 4
qawlanj, colics 14
qayy, vomiting 13
qilâ', glanders 11
qimqâm, crabs 3
qîrûṭî, wax-plaster 12
qurûḥ, ulcers 21
qurûn, corns (on the feet) 20
qurûn as-sinbil, poisonous parts of the nard 25
rabw, asthma 12
ramad, ophthalmia 8
rijâ', tumours (of uterus) 18
ri'sha, tremor 6

riyâḥ al-afrasa, spondylitis 6
ru'âf, bleeding at the nose 10
ruthailâ, mygale-spider 25
sabal, pannus of the cornea 8
sadad, syncope 7
sa'fa, excoriation 3
saḥj, dysentery 15
sakṭa, apoplexy 6
sal', hard tumour (fibroma?) 22
ṣal', baldness 3
ṣalâba, sclerosis 28
saqṭa, distortion 28
ṣar', falling sickness, epileptic convulsions 6
saraṭân, cancer 22
sayalân, fluxion 12
sayalân al-midda min al-adhn, otorrhoea 9
shahwa kalbiyya, canine appetite 13
shaqîqa, hemicrania 5
sharâ, blotch 21
sha'r munqalab, trichiasis of lids 8
shijâj (sing. *shajja*), wounds in the head 24
shiqâq, fissure 17
sh. al-'aqib, fissure of the heel 20
sh. ash-shiffa, fissure of the lip 11
shûkrân, hemlock 3
ṣîbân, nits 3
si'd, bulb of cyperus 25
sill, phthisis 12
simna, obesity 18
sirsâm, phrenitis 26
su'âl, cough 12
subât, lethargy 7
subât sahari, lethargy with insomnia 7
sulâq, ulcerous blepharitis 8
suqûṭ al-lahâh, falling off of the uvula 11
tahwî', nausea (also *tahawwu'*) 13
tanakhkhu', expectoration 12
tanakhnukh, expectoration 12
taqṭîr al-bawl, stillicidium 17
ṭarash, deafness 9
tashannuj, spasm 6
tathâ'ub, (continuous) yawning 26
tha'lîl, plur. *tha'âlîl*, wart 4, 20
tiryâq, theriac 25
'ûd Qamârî, Cambodjian aloes-wood 25
'uqad, callosities 20
wabâ', epidemic, plague 27
waram (plur. *awrâm*), tumour, swelling 22
wuthâ, dislocation 28
yaraqân, jaundice 16
ẓafara, pterygium 8
zarnîkh, arsenic 25
zift (rûmî), (Greek) pitch 25
zukâm, coryza 12
ẓulmat al-baṣar, dimness of sight, amblyopia 8
zunbûr, hornet 25

El Libro de Las Cruces

Una obra astrológica que Don Alfonso X, rey de España, mandó traducir del árabe.

ALFONSO X, rey de Castilla, denominado *el Sabio*, fué elevado al trono en el año 1252, por muerte de su padre el rey Fernando III el Santo, y duró su reinado hasta el año 1284.

Sin abandonar las cuestiones de gobierno ni sus pretendidos derechos a otros reinos se consagró con magno esfuerzo al cultivo de las Ciencias y de la Literatura.

Eruditos investigadores han estudiado la biografía de ALFONSO X y las obras importantes que compuso o mandó componer a los sabios que tuvo bajo su protección. En todas estas obras intervino el rey muy directamente.

Bien conocidas son sus recopilaciones históricas, tanto la « Crónica de España » como la « Grande y General Historia », su inmenso tratado sobre legislación titulado « Las Partidas », su maravilloso cancionero conocido por « Las Cantigas de Santa María », sus « Libros del saber de Astronomía » traducidos por sus astrónomos, pero revisados y corregidos por el rey en la redacción, y finalmente el « Libro del ajedrez » y el « Lapidario ». Este último hace sospechar que el rey ALFONSO X no era ajeno a las falsas creencias de la influencia de los astros y de los talismanes y amuletos.

A todas estas obras debe añadirse una, poco conocida, titulada « Libro de las cruces », que existe manuscrita en la Biblioteca Nacional de Madrid — manuscrito nº 9294 —. Es un precioso códice en pergamino, de 201 folios, letra gótica francesa del siglo XIII, que ha pasado inadvertido para muchos porque en el catálogo no figura como de ALFONSO X sino como de OVEIDALA. En efecto, el autor del libro original mandado traducir por ALFONSO X es un astrólogo árabe llamado OVEIDALA (UBAIDALLAH,

según la transcripción inglesa), del que no he podido conseguir ninguna noticia biográfica.

El « Libro de las cruces » es el primer libro de Astrología escrito en castellano y tiene el dato curioso de ser uno de los pocos en que ALFONSO X se titula rey de España, en vez de rey de Castilla, León, Toledo, etc. Bien es verdad que el libro está fechado en 1259, precisamente en el mismo año en que por haber querido llamarse « emperador de España » provocó la airada protesta de su suegro el rey de Aragón DON JAIME EL CONQUISTADOR.

El esmero con que todo el códice está escrito y la perfección caligráfica de las iniciales adornadas, dan un aspecto regio al manuscrito.

En cuanto al contenido del libro interesa llamar la atención acerca de dos extremos muy importantes. El primero es que, según consta en el *explicit*, lo tradujeron JEHUDA FY DE MOSSE y JOHAN DASPA, es decir, dos de los astrónomos que colaboran en los « Libros del saber de Astronomía » y en las « Tablas alfonsíes ». El segundo es que confirma la sospecha de que la superstición por la Astrología estaba muy arraigada en el rey ALFONSO y que todo su interés por la Astronomía teórica y por la formación de tablas astronómicas llevaba el oculto deseo de ajustar los actos de su vida a la influencia de los astros.

A todas las consideraciones anteriores, que tanto valor dan a esta obra, aún debe añadirse la circunstancia de actualidad, pues desde hace varios años pretenden algunos despertar la afición a la Astrología judiciaria, y en este sentido el « Libro de las cruces » es uno de los más útiles para poner de relieve el absurdo de toda clase de presagios astrológicos.

Desde las primeras páginas de este libro se advierte que el autor supone conocidas en el lector las nociones fundamentales de la Astrología judiciaria. Pero téngase en cuenta que en el « Libro de las cruces » se ve el propósito de presentar los casos que más pueden interesar a un rey.

Es norma sabida que, para formar los juicios astrológicos, se comienza por *levantar el horóscopo*, es decir, por hacer una *figura* o representación gráfica de la posición de los signos del Zodiaco, de los planetas, del Sol y de la Luna y de la Cabeza y Cola del Dragón en un momento determinado, ya sea el nacimiento de una persona, la declaración de una guerra, el comienzo

de un pleito, el momento de emprender un viaje, el principio del año, etc. La representación de los horóscopos es actualmente un anillo circular con las doce divisiones correspondientes a los signos del Zodiaco, en la que los arcos de cada división representan la projección de los arcos de la Eclíptica sobre el círculo ecuatorial. Durante los siglos XIV, XV y XVI se generalizó extraordinariamente el horóscopo construido sobre un cuadrado, que contenía doce triángulos representativos de los signos o « casas » del Zodiaco. Las *figuras* que utiliza el « Libro de las cruces » para la formación de los horóscopos responden a un método más primitivo, que consiste en un círculo dividido en seis sectores iguales mediante seis radios diametralmente opuestos; los seis sectores, llamados *àngulos*, y los seis radios, llamados *estacas*, se corresponden con las doce casas o signos del Zodiaco. Los seis radios forman tres diámetros que se cruzan en el centro de la figura y por esto se denomina el libro en cuestión « Libro de las cruces ».

En la Biblioteca de la Real Academia de la Historia, de Madrid, existe un breve manuscrito, titulado « Libro de las tres cruces » que es un resumen mal hecho de algunos de los capítulos del libro original que vamos a dar a conocer en este trabajo.

En el primer folio, con letra muy posterior, se lee :

« Libro de las cruzes || Que ficieron los sabios antigos || y que esplano Oveydalla el savio || e favlo en las constelaciones de las || reboluciones de los Plane || tas || que hallo y mando trasladar || de Aravigo en caste || llano || El mui noble Rey Don Alonso || hijo del muy noble Rey Don || fernando y de la muy || noble Reyna Dª || Beatriz. »

El libro da comienzo con un prólogo, que contiene algunos datos de interés, y a continuación inserta el índice de los capítulos en que se divide el libro.

Vamos a publicar aquí una copia fiel del prólogo y del índice aunque después no hagamos más que resumir el contenido de este *Libro de las cruces*.

« Esto es el prologo del libro de las cruzes. Assi como dixo tholomeu en el almageste non morro el qui abivo la sciencia et el saber ny fue sobre el qui fue dado a entendemiento. Onde en quanto el angel es mas alto et mas noble que el homne por su grand entendemiento et por su grand saber que dyos li dyo.

Assi el ombre en qui dyos quiso posar seso et entendemiento es mas alto et mas noble entre todos los homnes. Onde nostro sennor el muy noble Rey don Alfonso Rey despanna fyjo del muy noble Rey don ferrando et de la muy noble reyna dona beatriz en qui dyos puso seso et entendemiento et saber sobre todos los principes de su tyempo leyendo por diversos libros de sabios por alumbramyento que ovo de la gracia de dyos de quien vienen todos los bienes siempre se esforço de alumbrar et de abivar los saberes que eran perdidos al tyempo que dyos lo mando regnar en la tierra. Et porque el leyera et cada un sabio lo affirma el dicho de aristotil que dize que los cue[r]pos de yuso que son los terrenales se mantenen et se goviernan por los movementos de los corpos de suso que son los celestiales por voluntad de dyos. Entendio et connocio que la sciencia et el saber en connocer las significaciones destos corpos celestiales sobredichos sobre los corpos terrenales era muy necessaria a los homnes. Onde este nostro sennor sobredicho que tantos et diversos dichos de sabios viera leyendo que dos cosas son en el mundo que mientre son escondidas non prestan nada. Et es la una seso encerrado que non se amostra. Et la otra thesoro escondido en tierra. Et semeiando a Salamon en buscar y espaladinar los saberes doliendose de la perdida et la mengua que avian los ladinos en las sciencias de las significaciones sobredichas fallo el libro de las cruzes que fizieron los sabios antigos que esplano oveydalla el Sabio et favlo en las costellaciones de las revoluciones de las planetas et de sus ayuntamentos de lo que significan en los compeçamentos de los regnos et de los sennorios et de los accacementos del ayre grandes et generales. Et esto segund los ayuntamentos et las opposiciones et los otros catamientos de las quatro planetas de suso mayorment que son Saturno Jupiter mare et el Sol et mandolo transladar de aravigo en lenguage castellano et transladolo hyuhda fy de mosse alchoen mosca su alfaquim et su merçed. Et porque este libro en el aravigo non era capitulado mandolo capitular et poner los capitulos en compeçamento del libro segont es uso de lo fazer en todos los libros por fallar mas ayna et mas ligero las razones et los iud[i]zios que son en el libro. Et esto fizolo maestre Johan a su servicio. Et compieçan aqui los capitulos et a en este libro LXV capitulos.

El capitulo primero fabla en las reglas et en los dichos generales

et en algunos vocables proprios deste libro et exemplo dello.

El capitulo segundo fabla en la differencia de las yentes segund de las diversidades de sus moranças por diversas partidas de la tierra.

El capitulo tercero fabla en la particion de los signos por los poblos segund sus triplicitades et de cuemo las equationes de las planetas en sus coniunctiones et en sus oppositiones deven seer fechas con todos los movementos del cielo.

El capitulo quarto fabla en la esposicion de los dichos generales de los iudizios et son cinquo vocables apartados de que estos sabios usavan que son quadrantes quemantes encerrados erechos et iazientes.

El capitulo quinto fabla en las costellaciones que significan sequia et fambre et pedrisco et karistia et la[n]gostas et fazen en esto VIII cruzes diversas.

El capitulo sexto fabla en las terminaciones de los tiempos quando accaeceran las significaciones de los accidentes sobredichos. Et este capitulo es partido en dos maneras. La una es segund que qualquier de las dos planetas de las quatro sobredi[chas] son ayuntadas en una casa et qualquier de las otras dos es en quadradura de las dos ayuntadas. Et la otra manera es segund que qualquier de las dos planetas de las quatro sobredichas son oppositas de las dos ayuntadas et la otra de las dos es en quadradura de las otras et a en cada una manera dozientas et ocheynta et ocho figuras andando cada una por las XII casas en tres ordenes.

El capitulo septimo fabla en las faziendas de los Reyes et de sus adversarios et sus enemigos et en pleyto de matanças et de vençementos los unos a los otros et en las costellaciones que significan pazes entre ellos et contiene en sy X capitulos de diversas costellaciones et en este fabla soltament de los Reyes et de sus enemigos non parando myentes en al.

El capitulo VIII^{o} fabla en las costellaciones de los accaecementos que acaecen entre los Reyes et los sus enemigos acercandose unos a otros en sus villas de lo que lis accaece et de bienandança o de malandança de muerte o de presion o de paz. Et en este capitulo para mientes al bien et al mal que accaece a los Reyes et a sus enemigos segund sus villas et sus tierras por acometerse los unos a los otros en ellas. Et en este capitulo a IX capitulos desta razon.

El capitulo IX° fabla en las costellaciones de los accaecementos que accaecen entre las yentes unas con otras et desto ay VIII capitulos.

El capitulo X° fabla en las costellaciones que significan los grandes accaecementos que accaecen a los Reyes et en menguamento de sus regnos et en levantamento de las sus mismas yentes contra ellos et compieçan y las costellaciones que estos sabios nombran quemantes.

El capitulo undecimo fabla en esposicion et en determenar el movemento de la ochava espera et que todos los iudicios deben seer fechos por ello.

El capitulo dozeno fabla en los iudicios de la cabeça quando accaecen figuras quemantes que significa de los accidentes del ayre.

El capitulo trezeno fabla en los iudicios del Sol quando significan muerte de Reyes et destruyemiento de richos hombres et en termenar los tiempos quando accaecen los dannos o la bienandança.

El capitulo XIIII° fabla en las costellaciones que nombran quadrantes que significan fuertes lides et grandes dannos.

El capitulo XV° fabla de las costellaciones que nombran quemantes cerradas que significan fuertes accaecemientos en cercar villas et en lides.

El capitulo XVI° fabla en las costellaciones que nombran quemantes abiertas que significan muerte de Rey en su cabo et pocas matanças et dellas folgura et bienandança.

El capitulo XVII° fabla en otra manera de las quemantes cerradas que significan muchas occasiones et epidimias et mortandad de yente et sanna de reyes contra sus vasallos et sus aportellados.

El capitulo XVIII° fabla en los iudicios de las coniunctiones de las tres planetas que son Saturno Jupiter et Mares.

El capitulo XIX° fabla en los iudicios de las planetas oppositas.

El capitulo XX fabla en la costellacion que significa matança de rey con enganno et traicion.

El capitulo XXI° fabla apartadament en la opposicion de Jupiter et de Saturno et en determenar la bona significacion de la mala.

El capitulo XXII° fabla en las costellaciones de las quadraduras del Sol con mars quales son bonas et quales malas.

El capitulo XXIII° fabla de las quemantes et es de muyt fuertes et de viriguadas significaciones et ciertas.

El capitulo XXIIIIº fabla en las costellaciones que significan Karistia en viandas.

El capitulo XXVº fabla en las costellaciones que significan rafeçia et habondancia de pan et de las otras viandas et es partido en dos maneras.

El capitulo XXVIº fabla en saber el precio del pan en cada mes.

El capitulo XXVIIº fabla en conocer la fortuna et la infortuna de los signos.

El capitulo XXVIIIº fabla en las costellaciones que significan muchas lluvias et pocas et en gran sequia.

El capitulo XXVIIIIº fabla en los grandes accaecimentos de los Reyes et de sus vasallos qual accaeçen de partes de sus enemigos et en los dannos de sus villas et desto hay tres capitulos.

El capitulo XXXº fabla en saber en quales terras o en quales regnados accaeceran los accidentes sobredichos.

El capitulo XXXIº fabla del enfermo quando sanara et del preso quando saldra et del que a miedo quando sera fuera del miedo et del hombre pobre quando enrequicera et el richo quando se fara pobre et de algun hombre quando morra et de algun hombre quando vencera sus enemigos et en conocer quales signos son amigos et quales enemigos et en saber que sera de la baraia que accaece entre el varon et su mujer et en saber de dos hombres que varaiaron qual vençera.

El capitulo XXXIIº fabla en las elecciones de las costellaciones en que hombre gana en carreras et meiora su fazienda.

El capitulo XXXIIIº fabla en saber el tiempo en que el hombre a de seer preso a quien la costellacion significo que seria preso.

El capitulo XXXIIIIº fabla de saber el tiempo en que saldra el preso de la preson a quien significo la costellacion que abia de sallir.

El capitulo XXXVº fabla en saber de algun ombre si a de subir a dignidad o a alguna alteza et quando sera aquel tiempo.

El capitulo XXXVIº fabla en saber de algun prelado o de algun ensennorado o aportellado que a de seer despuesto daquella su dignidad et quando sera aquel tiempo et en termenar si sera por fechos que fizo despuesto o por accusaciones de todo et desto ay tres maneras de costellaciones que van por las XII casas.

El capitulo XXXVIIº fabla en saber la fin de las guerras et

de las lides que son entre los sallidos de tierra et entre el rey et qui vençera.

El capitulo XXXVIII° fabla en saber de algun hombre quando casara.

El capitulo XXXVIIII° fabla en iudgar la demanda por batalla o varaia que accaecio entre dos qual venç[e]ra et en saber el tiempo del vençer. Et en dar eleccion por alidiar. Et por a andar en cavalgada et en provar la cosa que hombre dize a otro si es verdat o mentira. Et en el precio del pan por cada mes segunt el estado de la quarta del anno. Et en saber de todos hombres o de dos compagnas que guerrean quien les venceran. Et en dar eleccion a los qui sallen lidiar et en la eleccion del Rey quando salle por fazer carrera longa.

El capitulo quadragesimo fabla en las costellaciones que significan fuertes matanças en que vencen los contralliadores et los adversarios.

El capitulo XLI° fabla en las costellaciones que significan sallida de Rey contra sus enemigos et destrymiento dellos et en saber el tiempo quando sera aquello.

El capitulo XLII° fabla en la sallida de los vasallos del rey et de sus cavallarias contra los enemigos del rey que significa destruymento de sus enemigos et que se apoderaran de sus villas sin travaio et sin enoio del Rey.

El capitulo XLIII° fabla en saber quando accaecera alguna occasion a algun ombre.

El capitulo XLIIII° fabla en saber lo que mengua el danno et el infortunio que significan las infortunias.

El capitulo XLV° fabla en las costellaciones que significan las fuertes lluvias et los aguaduchos.

El capitulo XLVI° fabla en las costellaciones que significan bienandança del Rey en su fazienda.

El capitulo XLVII° fabla en las costellaciones que significan los malos accaecementos de los reys.

El capitulo XLVIII° fabla en las costellaciones que significan apoderamento del rey sobre sus enemigos por manna et por sabiduria sin lid.

El capitulo XLVIIII° fabla en las costellaciones que significan matanza de los Reys sin lid et sin batalla por trayciones et por engannos.

El capitulo çinquanteno fabla en las costellaciones que significan matanças de los enemigos et de los contralliadores del rey.

El capitulo çinquanteno et uno fabla en las costellaciones que significan matanças de reys en lides et en batallas.

El capitulo LIIº fabla en las costellaciones que significan muerte et destruyemiento de los aportellados del rey.

El capitulo LIIIº fabla en las costellaciones que significan acercamiento de los castiellos et de las villas en que vençen los de la villa o los del castiello a los qui lo tyenen acercados.

El capitulo LIIIIº fabla en las costellaciones que significan acercamiento de los castiellos et de las villas quando son vencidos o destruydos los qui estan dentro et se prende la villa o el castiello et lo malmeten.

El capitulo LVº fabla en las costellaciones que significan lides et batallas en que venceran los sallidos del reyno y los contralliadores.

El capitulo LVIº fabla en las costellaciones que significan yrmamento et destruyemento de las villas et de las cibdades.

El capitulo LVIIº fabla en conocer los annos que son lluviosos o secos karos o abondados.

El capitulo LVIIIº fabla en conocer las significaciones et las sennales que significan morte de hombre.

El capitulo LVIIIIº fabla en saber la soma de los grados ensennorados sobre las principales villas antiguas despanna. Et en las planetas sobre quales mansiones an poderio et las mansiones sobre quales de las villas despanna. Et en la diversidad de las opiniones de los sabios sobre el signo despanna qual es et del sennorio de las planetas sobre diversas yentes.

El capitulo LXº fabla en los precios del pan et en las lluvias et sequias et en las abondancias et en las karistias segont la partida de los sabios antigos qui iudgan por este libro de las cruzes et otorganse en esto con los sabios orientales et con los de babilonia.

El capitulo LXIº fabla en las significaciones de Saturno et de Jupiter quando fueren en diversas triplicitades el uno en la una el otro en la otra.

El capitulo LXIIº fabla en las significaciones de Saturno et Jupiter quando fuere et uno en una triplicitat sennalada et el otro en otra triplicitat sennalada.

El capitulo LXIIIº fabla en las significaciones de saturno quando fuere con la cabeça del dragon.

El capitulo LXIIIIº fabla en las significaciones de saturno et de iupiter por los catamentos quando se catan de trino o de quadradura a diestro o a siniestro.

El capitulo LXVº fabla en otra manera de costellaciones que significan sequia et mengua de aguas et en otros accidentes malos que accaecen a las villas et a las tierras.

Et aqui se acaban los capitulos deste libro de las cruzes. Et aqui compieça el texto del libro segont fue transladado del aravigo.

El prólogo y el índice que anteceden, literalmente copiados, demuestran claramente el interés de esta obra en su aspecto literario y filológico. Pero como el objeto del presente trabajo es hacer un estudio de su contenido astrológico, explicaremos en castellano actual todo el « Libro de las cruces », haciendo una traducción libre del mismo, sin omitir ningún pormenor.

Comienza el texto por la consabida invocación : « En el nombre de Dios. Este es el libro de las cruces en los juicios de las estrellas que explanó OVEIDALLA ».

OVEIDALA formó este libro « por haber observado en autores antiguos que es muy aprovechable el conocimiento de las constelaciones del Zodiaco y las posiciones de los planetas en relación con los sucesos que tienen lugar en el aire, en los reinos, en los señoríos y en las personas ».

Dice que encontró este libro, en el que se trata de las constelaciones o agrupaciones de estrellas y planetas, consideradas aisladamente, y afirma que tales constelaciones tienen un poder singular, modificado por las influencias que tienen los planetas superiores — Saturno, Júpiter, Marte y Sol — y que donde más claramente se observan estas influencias es en los accidentes atmosféricos y en los estados de guerra y de paz entre los hombres.

Los juicios que va a exponer son los mismos que usaban los astrólogos antiguos de Occidente, Africa, Berbería y la España romana. Añade que los sabios orientales, babilonios, egipcios, persas y griegos, complicaban sus juicios con muchas sutilezas, que no se deben considerar tan fundamentales como las propias significaciones de las constelaciones.

Como preliminar obligatorio hace el estudio del Zodiaco puesto que es la base de los horóscopos. El Zodiaco es una zona de la esfera celeste que se considera dividida a lo largo en doce partes

que se llaman *casas*. Por estas casas hacen su recorrido las doce constelaciones o signos del Zodiaco y los planetas, pero cada casa tiene asignada una determinada constelación. Cada casa tiene

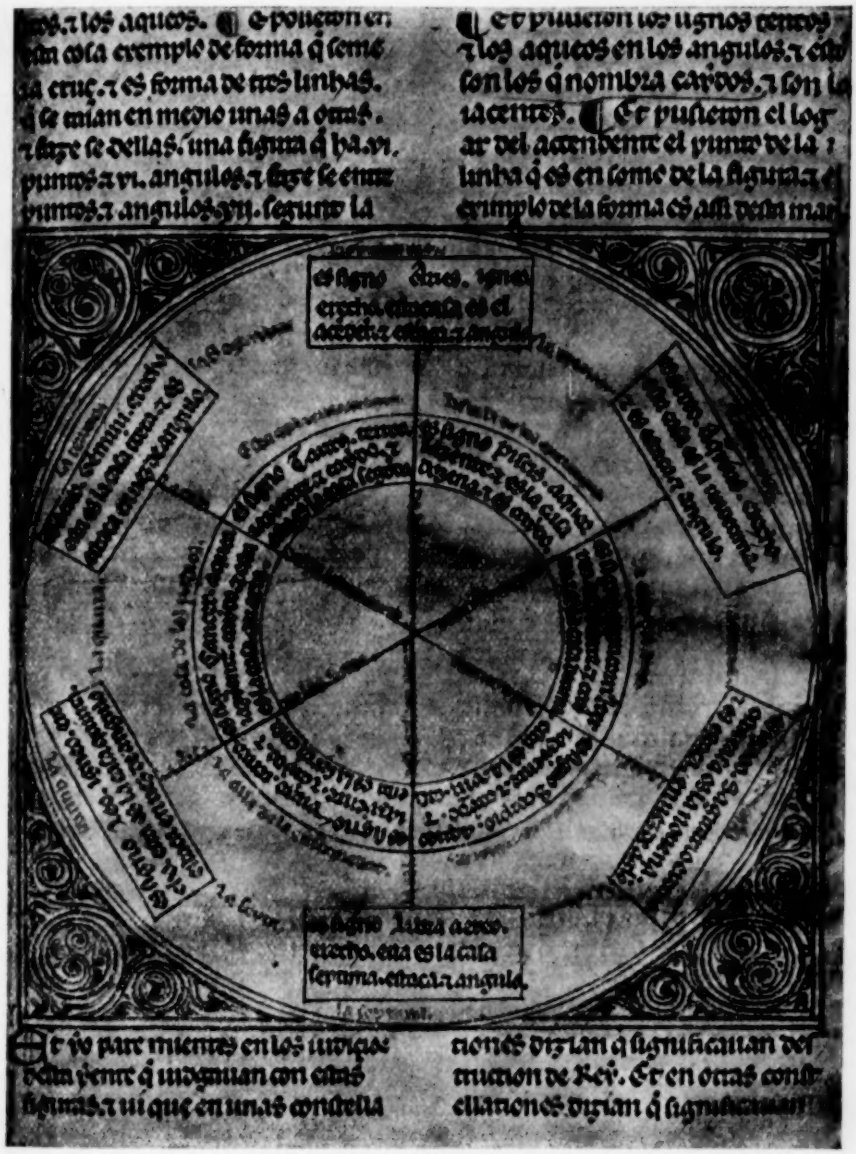

Fig. 1

su significación especial, cada signo del Zodiaco su influencia característica y cada planeta su carácter específico. Añádase a esto que la posición relativa de los elementos — casas, signos, planetas — modifica o trastorna las influencias individuales y se comprenderá la necesidad de hacer una representación gráfica de la situación de dichos elementos en el momento de la observación.

La representación gráfica que emplea no es la forma circular, dividida en doce sectores, que se usa actualmente, ni el cuadrado dividido en dos triángulos, que fué la forma clásica en las Edades media y moderna, sino que traza un círculo y lo divide mediante tres diámetros en seis sectores iguales. He aquí literalmente cómo hace la descripción : « Et posieron en esta cosa exemplo de forma que semeia cruç et es forma de tres linhas que se taian en medio unas a otras et fase se dellas una figura que ha VI puntos et VI angulos et fase se entre puntos et angulos XII segunt la cuenta de los signos et pusieron los signos igneos et los aereos en los puntos de las linhas et estos son los que nombran estacas que son los erechos. Et pusieron los signos terreos et los aqueos en los angulos et estos son los que nombra caydos et son los iacentes. Et pusieron el logar del accendente el punto de la linha que es en somo de la figura et el eximplo de la forma es assi desta manera » (1).

En la práctica se dibuja solamente el círculo con los tres diámetros y se sobrentiende que los seis radios y los seis ángulos en el centro se hacen corresponder a las doce casas, como indica esta figura 2 :

Denomina *estacas* a las casas 1ª, 3ª, 5ª, 7ª, 9ª y 11ª. Los signos en las estacas son *estantes* o *erechos*.

Denomina *ángulos* a las casas 2ª, 4ª, 6ª, 8ª, 10ª y 12ª. Los signos en los ángulos son *cayentes*, *caidos* o *yacentes*.

También denomina *ángulos del Cielo* a las cuatro casas que se corresponden con los cuatro puntos cardinales, o sea 1ª, 4ª, 7ª y 10ª. Por esto dice que la casa 1ª es estaca y ángulo.

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(1) Con esta descripción queda bien justificado el título del *Libro de las cruces* o sea de las figuras a modo de cruz y por esto resulta anómalo el título que lleva el manuscrito 26-7ª-D-181 de la Real Academia de la Historia : el copista, por ignorancia, lo ha titulado *Libro de las tres cruces*. Dicho manuscrito, relativamente moderno, es un resumen del libro de OVEIDALA con bastantes errores de interpretación de las doctrinas astrológicas, como ya indicamos al principio.

Los signos del Zodiaco están clasificados del modo que sigue:
Signos *igneos* .... Aries, Leo, Sagitario;
Signos *aereos* .... Géminis, Libra, Acuario;
Signos *terreos* .... Tauro, Virgo, Capricornio;
Signos *acueos* ... Cáncer, Escorpión, Piscis.

La correspondencia establecida entre las casas, sus significaciones los signos asignados y la condición de signos y casas es la siguiente:

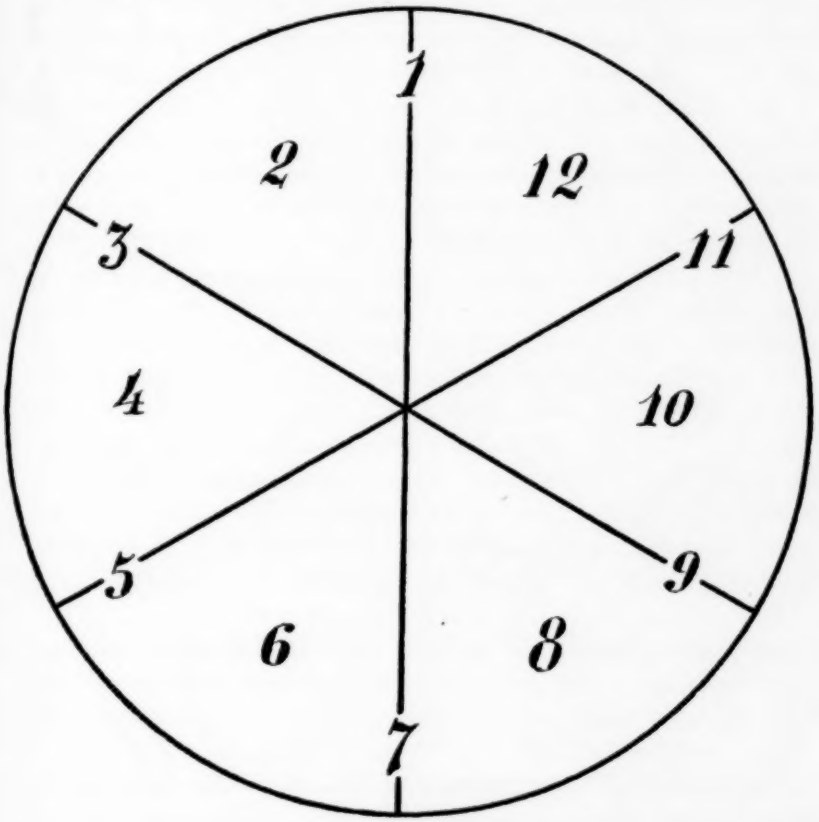

FIG. 2

1ª casa o ascendente = Es la casa de la vida = Su signo es Aries; es igneo y erecho = Es estaca y ángulo.

2ª casa ..... = Es la casa del haber = Su signo es Tauro; es terreo, yacente y caido = Es ángulo.

3ª casa ..... = Es la casa de los hermanos = Su signo es Géminis; es aereo y erecho = Es estaca.

4ª casa ..... = Es la casa de los padres = Su signo es Cáncer; es acueo, yacente y caido = Es ángulo.

5ª casa ..... = Es la casa de los hijos = Su signo es Leo; es igneo y erecho = Es estaca.

6ª casa ..... = Es la casa de la enfermedad = Su signo es Virgo; es terreo, yacente y caido = Es ángulo.

7ª casa ..... = Es la casa del casamiento = Su signo es Libra; es aereo y erecho = Es estaca y ángulo.

8ª casa ..... = Es la casa de la muerte = Su signo es Escorpión; es acueo, yacente y caido = Es ángulo.

9ª casa ..... = Es la casa de la carrera = Su signo es Sagitario; es igneo y erecho = Es estaca.

10ª casa ..... = Es la casa de los reyes = Su signo es Capricornio; es terreo, yacente y caido = Es ángulo.

11ª casa ..... = Es la casa de los amigos = Su signo es Acuario; es aereo y erecho = Es estaca.

12ª casa ..... = Es la casa de los enemigos = Su signo es Piscis; es acueo, yacente y caido = Es ángulo.

CAPÍTULO II. Trata en este capítulo de un asunto totalmente ajeno al resto del libro. Define la nobleza de los pueblos por el conjunto de sus leyes y decretos, por su gobierno bajo un rey o señor y por su ciencia y conocimientos. Clasifica los pueblos, en orden de mayor a menor nobleza, de este modo: 1º Los de Arín (2). 2º Los de India. 3º Los de Babilonia y Persia. 4º Los

(2) Arín o Azín, según las investigaciones de NALLINO, era la isla de Lanka, hoy Ceilán, que antiguamente se consideró como el centro intelectual de la India.

de Roma. Advierte que deben excluirse los etiopes, aunque viven cerca de los indios, y deben excluirse asimismo los turcos y los castrados, aunque se encuentran cerca de Persia. En cambio, dice que junto a los romanos deben contarse a los griegos, aunque haya decaido su civilización. Termina afirmando que en el tiempo en que se escribe el libro, los árabes son los más nobles entre los pueblos occidentales.

CAPÍTULO III. Aquí reproduce y acepta las hipótesis de los astrólogos antiguos, con alusión directa a ABUMAXAR y su *Libro de las conjunciones*. De acuerdo con la astrología antigua los signos igneos son significadores de los árabes (occidentales), los signos aereos son significadores de los bárbaros (orientales), los signos acueos son significadores de los romanos (occidentales) y los signos terreos son significadores de los indios (orientales). Las conjunciones de planetas que tienen lugar en signos igneos o aereos son favorables para los orientales y adversas para los occidentales. Ocurre lo contrario si las conjunciones tienen lugar en signos acueos o terreos. Estos juicios se han visto confirmados por los árabes, según manifiesta, en las conjunciones de los años 397 y 459 de la Hégira. (1006-1007 y 1066-1067 de J. C.).

Señala, como dato de gran interés, que para formar juicios de Astrología se ha de atender al « movimiento tardío de la ochava esfera » y que las tablas que se han compuesto, sin tener en cuenta el movimiento de precesión, conducen a errores en los juicios.

CAPÍTULO IV. Da un significado muy amplio al concepto de constelación, pues asigna este nombre a un conjunto de determinados astros en la posición que ocupen, cualquiera que ésta sea. Así una constelación es *cuadrante* si alguno de los astros que la componen esta formando ángulo de 90º con otros de la misma; es *quemante* si todos o la mayoría de los astros están en un mismo signo o en signo de igual denominación, por ejemplo, en signos terreos; se llama *encerrada*, si los planetas que forman parte de ella son retrógrados.

Indica que los astrólogos han usado símbolos para representar los planetas, la Cabeza de dragón y la Cola de dragón, pero advierte que en este libro no empleará estos símbolos sino los nombres de los astros. Los símbolos aludidos son los siguientes :

Saturno	♄	Sol	☉	Luna	☽
Júpiter	♃	Venus	♀	Cabeza de dragón	☊
Marte	♂	Mercurio	☿	Cola de dragón	☋

FIG. 3

CAPÍTULO V. Comienza el estudio de las constelaciones cuadrantes en el caso particular de que la constelación la formen Saturno y Júpiter en cuadratura, únicamente en las casas 2ª, 5ª, 8ª o 11ª. Esto da lugar a ocho « cruces diversas »; las ***cruces*** o figuras las representa en otros tantos círculos del modo siguiente :

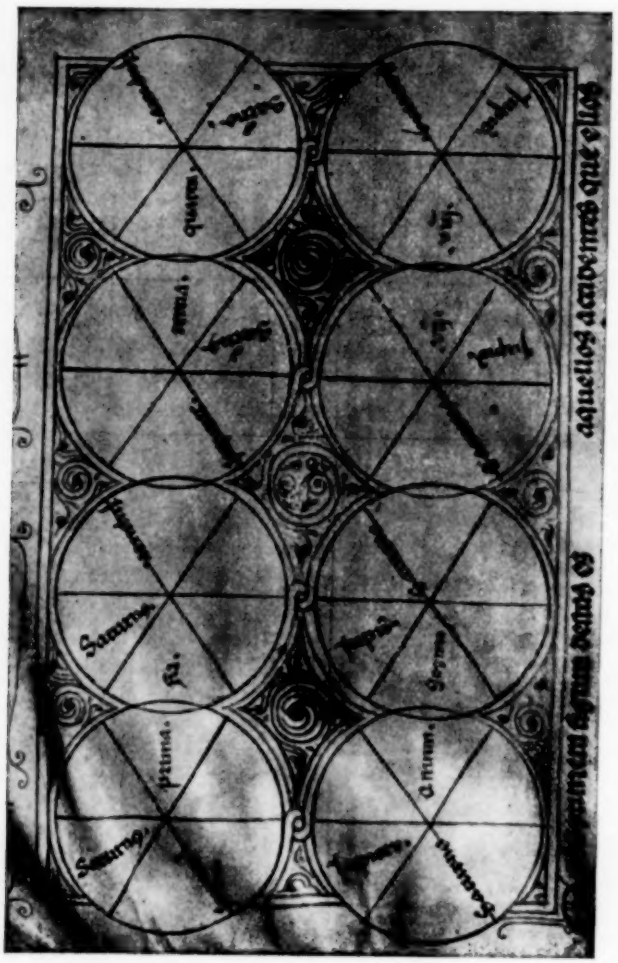

FIG. 4

Todo el libro está lleno de figuras análogas a éstas para representar las constelaciones. En lo sucesivo, para no reproducir las representaciones gráficas, haremos la indicación de las casas en que se encuentran los astros para que fácilmente pueda el lector reconstruir las figuras. Las ocho figuras anteriores se expresarán del modo que sigue, según el sistema que vamos a adoptar :

Saturno	2	2	8	8	5	11	5	11
Júpiter	5	11	5	11	2	2	8	8

Para formar juicios astrológicos sobre estas constelaciones es preciso que tengan lugar en el comienzo del hecho enjuiciable, ya sea nacimiento de una persona, momento de emprender un viaje, principio de un reinado, etcétera. Ha de tenerse a la vez en cuenta la influencia y el estado particular de cada planeta para saber si se intensifica o se atenúa la significación de la constelación.

En general, las cuadraturas, oposiciones y conjunciones de Saturno y Júpiter son comienzo de grandes accidentes. Los ocho casos antes considerados son señal de hambre y carestía. Si se presentan en invierno anuncian grandes fríos, lluvias abundantes y perjuicio en las tierras. Si se presentan en verano anuncian pedriscos, langostas y plagas. Indica, sin hacer nuevas figuras, que los juicios anteriores se agravan si la Luna se encontrara en las casas 1 ó 7.

CAPÍTULO VI. Es un capítulo muy extenso porque estudia las combinaciones que pueden formarse con los « planetas » Sol, Marte, Júpiter y Saturno, suponiendo dos de ellos en conjunción y uno de los otros dos en cuadratura, o dos de ellos en oposición y uno de los otros dos en cuadratura. Con estos elementos obtiene 288 « constelaciones » distintas. Este capítulo puede considerarse como ampliación del anterior, en cuanto a los juicios astrológicos.

Primer grupo : 96 figuras en que intervienen las casas 2ª u 8ª.

Sol y Saturno	2	2	8	8	5	11	5	11
Júpiter	5	11	5	11	2	2	8	8

Estas ocho figuras se repiten para cada una de las combinaciones siguientes :

Sol y Saturno	Sol y Júpiter	Sol y Júpiter	Marte y Sol
Marte	Saturno	Marte	Saturno

Marte y Sol Júpiter	Saturno y Marte Sol	Saturno y Marte Júpiter	Júpiter y Marte Sol
Júpiter y Marte Saturno	Saturno y Júpiter Sol	Saturno y Júpiter Marte	

Segundo grupo : Otras 96 figuras en que intervienen las casas 3ª o 9ª.

Sol y Saturno	3	3	9	9	6	12	6	12
Júpiter	6	12	6	12	3	3	9	9

También se repiten estas ocho figuras para las combinaciones :

Sol y Saturno Marte	Sol y Júpiter Saturno	Sol y Júpiter Marte	Marte y Sol Saturno
Marte y Sol Júpiter	Saturno y Marte Sol	Saturno y Marte Júpiter	Júpiter y Marte Sol
Júpiter y Marte Saturno	Saturno y Júpiter Sol	Saturno y Júpiter Marte	

Tercer grupo : Otras 96 figuras en que intervienen las casas 4ª ó 10ª. (Sin embargo, solamente incluye las figuras que corresponden a las combinaciones de Sol, Saturno y Marte. Las figuras restantes las deja para más adelante, porque sus presagios son benignos).

Sol y Saturno	1	1	7	7	4	10	4	10
Marte	4	10	4	10	1	1	7	7

Otras ocho figuras para cada una de las dos combinaciones siguientes :

Marte y Sol Saturno	Saturno y Marte Sol

Interpretación astrológica de las figuras anteriores :

Conjunción de Saturno y Júpiter.

en la casa 2 = Carestía. Disminución de ganancias y haberes.
» 3 = Hambre. Gran espanto en las gentes.
» 5 = Hambre y espanto. Desgracias en los fetos. Abortos.
» 6 = Alzamientos de siervos en contra de los señores.

» 8 = Enfermedades, epidemias, fiebres largas, mal de bazo, etc.
» 9 = Desprecio e incumplimiento de las leyes.
» 11 = Desgracias en los privados del Rey y personas que le rodean.
» 12 = Desgracias en los siervos y gente de baja condición social.

Conjunción de Saturno y Marte.
en la casa 2 = Carestía por gran sequedad y falta de lluvia.
» 3 = Espanto y desasosiego en las gentes. Huídas de un lugar a otro.
» 5 = Desgracias en los niños, abortos, muertes de parto.
» 6 = Luchas y matanzas entre gente baja.
» 8 = Mortandad. Epidemias graves.
» 9 = Abundancia de ladrones y salteadores de caminos. Fornicaciones.
» 11 = Desgracias y luchas entre caballeros del Rey, *ricos-homes* y señores.
» 12 = Triunfo de los enemigos del Rey.
» 1 = Enfermedades de melancolía. Endemoniados.
» 4 = Terremotos, tempestades, perjuicios en los campos y lugares.
» 7 = Mortandad y epidemias en mujeres y animales hembras.
» 10 = Disgusto y despecho del Rey para con el pueblo.

Conjunción de Saturno y Sol.
en la casa 2 = Carestía por langostas y plagas del campo.
» 3 = Intranquilidad del Rey y su traslado de lugar.
» 5 = Desgracia o perjuicio al heredero del Reino.
» 6 = Desgracia en los siervos del Rey, probablemente por causa de éste.
» 8 = Mortandad por hemorragias, postemas y fiebres.
» 9 = Daños ocasionados por no cumplir la ley el Rey, los jueces y prelados.
» 11 = Disgusto, despecho y venganza del Rey en sus mayordomos y aportellados.
» 12 = Perjuicios por causa de grandes fríos y fuertes vientos.

» 1 = Los nacidos bajo el influjo de esta conjunción vivirán poco.
» 4 = Daños materiales por grandes aguaceros.
» 7 = Desgracias o perjuicios en las mujeres del Rey.
» 10 = Odio del pueblo al Rey. Sublevaciones y alzamientos.

Conjunción de Júpiter y Marte.
en la casa 2 = Carestía por exceso de calor que perjudique mieses y árboles.
» 3 = Los monstruos causarán daño a los hombres y los poblados.
» 5 = Perjuicios en las cosechas.
» 6 = Las prisiones serán de larga duración.
» 8 = Mortandades con intervención de la justicia.
» 9 = Muertes y destrucciones en los que no cumplan la ley.
» 11 = Desgracias y perjuicios a los alcaldes y jueces con intervención del Rey.
» 12 = Carestía por pérdida de la cosecha de cereales.

Conjunción de Júpiter y Sol.
en la casa 2 = Fuerte carestía por exceso de lluvia a destiempo.
» 3 = Males ocasionados por subir al poder los hombres viles.
» 5 = El Rey dará el reino a quien no le corresponde.
» 6 = Enfermedades en los miembros.
» 8 = Enfermedades largas, sin llegar a mortales.
» 9 = Muchos hombres ingresarán en conventos o se harán ermitaños.
» 11 = Desgracias en los adelantados, por causa del Rey, injustamente.
» 12 = Castigos y tributos, impuestos injustamente por el Rey.

Conjunción de Marte y Sol.
en la casa 2 = Sequía exagerada, verano caluroso, invierno templado, lluvias perjudiciales, tormentas.
» 3 = Desgracias por levantarse contra el Rey sus hermanos o parientes.
» 5 = Gran hambre y sed.
» 6 = Traición por parte de los servidores del Rey.

» 8 = Malas enfermedades: postemas en los costados, fiebres agudas, viruelas, etc.
» 9 = Derrota del Rey, con pérdida de gran parte de su gente.
» 11 = Desgracias por alzarse los caballeros y *ricos-homes*, que serán vencidos por el Rey.
» 12 = Victoria del Rey sobre sus enemigos.
» 1 = Espanto y miedo producidos por cometas y fenómenos del cielo.
» 4 = Perjuicios en casas y lugares por rayos, bólidos, etc.
» 7 = Desgracias por alzarse los parientes de la mujer del Rey.
» 10 = Muerte del Rey a traición y con tóxico.

Hace observar que estos juicios se han de completar e interpretar enlazándolos con las significaciones ya conocidas de los signos, en que estén los planetas, con relación a los pueblos.

Continuando ahora las figuras del tercer grupo expone las combinaciones siguientes:

Saturno y Sol	1	1	7	7	4	10	4	10	
Júpiter	4	10	4	10	1	1	7	7	

Y repite las ocho figuras para las combinaciones:

Sol y Júpiter	Sol y Júpiter	Marte y Sol	Saturno y Marte
Saturno	Marte	Júpiter	Júpiter

Júpiter y Marte	Júpiter y Marte	Saturno y Júpiter	Saturno y Júpiter
Sol	Saturno	Sol	Marte

Interpretación astrológica de estas figuras:

Todos los presagios son de felicidad y bienestar cuando Júpiter ocupa uno de los cuatro ángulos del cielo o sea alguna de las casas 1, 4, 7 ó 10.

Las 288 constelaciones expuestas contienen una conjunción de dos planetas. Si estos mismos dos planetas se colocan en oposición podremos obtener otras 288 constelaciones. La formación de las ocho primeras figuras del primer grupo sería:

Sol	2	2	8	8	5	11	5	11	
Saturno	8	8	2	2	11	5	11	5	
Júpiter	5	11	5	11	2	2	8	8	

y de una manera análoga se obtienen las 280 restantes.

Los juicios astrológicos son exactamente lo mismo estando en oposición que en conjunción. Como es lógico, es también de buen presagio que Júpiter ocupe una de las casas 1, 4, 7 ó 10.

CAPÍTULO VII. Está dividido en diez subcapítulos.

Primero. La conjunción del Sol con uno de los planetas superiores, Saturno, Júpiter o Marte, coincidiendo en el signo correspondiente al Sol, que es León, o en su exaltación, que es Aries (3), significa que el Rey vencerá a sus enemigos, si los signos León o Aries pertenecieran a dicho Rey. En caso contrario la conjunción anuncia grandes batallas sangrientas. Las seis figuras representativas colocan la constelación en la casa 1 del modo siguiente :

Aries	Aries	Aries	León	León	León
Sol	Sol	Sol	Sol	Sol	Sol
Saturno	Júpiter	Marte	Saturno	Júpiter	Marte

Segundo. Conjunción de Sol y Marte en la casa 7 y oposición de Saturno o Júpiter. Esto da lugar a dos figuras :

Sol y Marte	7	Sol y Marte	7
Saturno	1	Júpiter	1

Si la conjunción es en un signo asignado al Rey presagia que matarán al Rey sus propios caballeros, y si es en un signo asignado a los enemigos del Rey, matarán al enemigo.

Tercero. Si a las dos figuras anteriores se añade que la Cabeza de dragón (Caput) está en la casa 10, ya no significa muerte de Rey, pero sí que habrá lides, batallas y homicidios, resultando victoriosos aquellos que estén bajo el influjo del signo en que se verifique la conjunción. Las dos figuras para este caso son :

Sol y Marte	7	Sol y Marte	7
Saturno	1	Júpiter	1
Caput	10	Caput	10

Cuarto. La misma conjunción de Sol y Marte en una de las casas 3, 6, 9, 12, y la oposición de Saturno o Júpiter significa la destrucción de los enemigos. Las figuras son ocho :

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(3) La exaltación es la posición en que mayor influencia tiene un astro. En la Astrología arabe se admite la exaltación de Sol en Aries, de Luna en Tauro, de Saturno en Libra, de Júpiter en Cáncer, de Marte en Capricornio, de Venus en Piscis y de Mercurio en Virgo.

Sol y Marte	3	9	6	12		Sol y Marte	3	9	6	12	
Saturno	9	3	12	6		Júpiter	9	3	12	6	

Quinto. Si en estas últimas figuras se añade la Cabeza de dragón en uno de los ángulos del cielo (casas 1, 4, 7 ó 10), o sea en posición de sextil o de trino (4) ya no significa matanza alguna sino paz y sosiego. Resultan, pues, dieciséis figuras: ocho de sextil y ocho de trino.

Sol y Marte	3	9	6	12		Sol y Marte	3	9	6	12	
Saturno	9	3	12	6		Júpiter	9	3	12	6	
Caput	1	7	4	10		Caput	1	7	4	10	

Sol y Marte	3	9	6	12		Sol y Marte	3	9	6	12	
Saturno	9	3	12	6		Júpiter	9	3	12	6	
Caput	7	1	10	4		Caput	7	1	10	4	

Sexto. Los elementos que forman la constelación son los siguientes: conjunción de Sol y Saturno en la casa 7, Marte en la casa 5 ó 9 (sextil) o en la casa 11 ó 3 (trino), Júpiter en conjunción o en oposición con Marte. La combinación de estos elementos produce ocho figuras:

Sol y Saturno	7	7	7	7		Sol y Saturno	7	7	7	7	
Marte y Júpiter	9	5	11	3		Marte	9	5	11	3	
						Júpiter	3	11	5	9	

La interpretación astrológica en estos casos es la destrucción del Rey o del caudillo enemigo que se encuentre bajo el poder del signo en que se verifique la conjunción de Sol y Saturno.

Séptimo. El Sol en la casa 1 ó 7, Marte en la casa 3 ó 9 y Saturno o Júpiter en oposición a Marte. Las figuras son estas ocho:

Sol	1	1	7	7		Sol	1	1	7	7	
Marte	3	9	3	9		Marte	3	9	3	9	
Saturno	9	3	9	3		Júpiter	9	3	9	3	

El presagio depende del signo en que se halle Marte, que es el planeta del infortunio: después de grandes matanzas y fuertes lides será vencido el que se halle bajo el influjo de aquel signo.

Añade, como regla general, que si hay astros infortunados en

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(4) La posición o aspecto sextil quiere decir formando ángulo de 60° y la posición trino quiere decir formando ángulo de 120°.

las casas 3 ó 9 quiere decir grandes movimientos, tribulaciones, lides y muertes.

Octavo. El Sol en la casa 7, Marte en la casa 3 ó 9 y Saturno o Júpiter en oposición al Sol, o sea en la casa 1. El presagio es el mismo anterior respecto a los reyes, pero con pocas matanzas y escasa lid. Las figuras son cuatro :

Sol	7	7		Sol	7	7	
Marte	3	9		Marte	3	9	
Saturno	1	1		Júpiter	1	1	

Noveno. El Sol y Marte como en el caso anterior y Saturno o Júpiter en conjunción con el Sol. La interpretación astrológica es la misma que en el subcapítulo séptimo. Hay cuatro figuras.

Saturno-Sol	7	7		Júpiter-Sol	7	7	
Marte	3	9		Marte	3	9	

Décimo. El Sol en una de las doce casas. Marte situado cuatro casas detrás del Sol o bien ocho casas detrás. Esta constelación significa pocas matanzas, pero mucho espanto, miedo y daño en el pueblo indicado por el signo en que se encuentre Marte. En el manuscrito solamente existen cuatro figuras que son :

Sol	1	1	2	2				
Marte	5	9	6	10				

Aquí falta uno o dos folios al manuscrito, en los cuales probablemente existirían estas otras figuras :

Sol	3	3	4	4	5	5	6	6	7	7		
Marte	7	11	8	12	9	1	10	2	11	3		
Sol	8	8	9	9	10	10	11	11	12	12		
Marte	12	4	1	5	2	6	3	7	4	8		

CAPÍTULO VIII. Está dividido en nueve subcapítulos según indica en el título del capítulo. Falta el folio que contiene el principio del subcapítulo tercero. El texto también se interrumpe después del quinto subcapítulo y continúa con las figuras que corresponden al noveno. Hay que suponer, por consiguiente, que faltan uno o dos folios.

Primero. El Sol en las casas 1 ó 7. La conjunción de Marte y Júpiter o de Marte y Saturno está en cuadratura con el Sol. El presagio es de muerte del Rey o del príncipe heredero que

esté bajo el influjo del signo en que se halle la conjunción; el hecho ocurrirá durante el cerco de una villa propia o enemiga. Tiene como significación especial la victoria de los pueblos de Occidente contra los de Oriente. Presenta ocho figuras :

Sol	1	1	7	7			
Marte y Júpiter	4	10	4	10			
Sol	1	1	7	7			
Marte y Saturno	4	10	4	10			

Segundo. Saturno y Júpiter, en oposición, ocupan las casas 1, 4, 7, 10 y el Sol, en cuadratura, ocupa alguna de las mismas casas. Anuncia que un movimiento enemigo vendrá de Occidente, cercará al Rey y conquistará sus villas. Pone estas cuatro figuras, pero dice que son ocho :

Saturno	1	1	7	7
Sol	4	10	4	10
Júpiter	7	7	1	1

Por el texto se deduce que las otras cuatro son :

Saturno	4	4	10	10
Sol	1	7	1	7
Júpiter	10	10	4	4

Tercero. A él se refieren estas dieciséis figuras :

Sol	1	1	1	1	7	7	7	7
Marte	4	4	10	10	4	4	10	10
Saturno	6	12	6	12	6	12	6	12
Sol	1	1	1	1	7	7	7	7
Marte	4	4	10	10	4	4	10	10
Júpiter	6	12	6	12	6	12	6	12

Cuarto. El Sol en la casa 12 ó en la 6. Marte en la 3 ó en la 9. Júpiter o Sartuno en la 5 ó en la 11. La interpretación astrológica es el triunfo del Rey sobre sus enemigos.

Sol	12	12	12	12	6	6	6	6
Marte	3	3	9	9	3	3	9	9
Saturno	5	11	5	11	5	11	5	11
Sol	12	12	12	12	6	6	6	6
Marte	3	3	9	9	3	3	9	9
Júpiter	5	11	5	11	5	11	5	11

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Noveno. Le corresponden las veinticuatro figuras que siguen:

Marte y Saturno	1	1	2	2	3	3	4	4	5	5	6	6
Júpiter	4	10	5	11	6	12	7	1	8	2	9	3

Marte y Saturno	7	7	8	8	9	9	10	10	11	11	12	12
Júpiter	10	4	11	5	12	6	1	7	2	8	3	9

CAPÍTULO IX. Dividido en ocho subcapítulos.

Primero. Dos de los tres planetas superiores, Saturno, Júpiter o Marte, están en conjunción o en oposición y el Sol en cuadratura y situado en cualquier casa. La interpretación astrológica es que la gente representada por el signo en que están los planetas vencerá a la representada por el signo en que está el Sol. Si el juicio no se refiere a rivalidades de pueblos, se hace la interpretación más en consonancia con la establecida anteriormente. Las figuras son setenta y dos para el caso de conjunción y otras tantas si hay oposición.

Saturno y Júpiter	1	1	2	2	3	3	4	4	. . . .		12	12	‖
Sol	4	10	5	11	6	12	7	1			3	9	‖

Saturno y Marte	« las mismas combinaciones »		‖
Sol			‖

Júpiter y Marte	« las mismas combinaciones »		‖
Sol			‖

Las setenta y dos figuras correspondientes para el caso de oposición se forman de cada una de las setenta y dos anteriores, colocando el segundo planeta de los que están en conjunción en la casa opuesta. Asi la primera figura es

Saturno	1
Júpiter	7
Sol	4

y la última es

Júpiter	12
Marte	6
Sol	9

Segundo. Marte en conjunción con Saturno o Júpiter y el Sol

en cuadratura. El presagio en estos casos es de desgracias y pérdidas de territorios en las gentes que estén bajo el signo en que se encuentre el Sol, y vencerán en la lucha los que estén bajo el signo en que se encuentre la conjunción. El suceso que presagia ocurrirá cuando entre el Sol o la Luna en las casas 1 ó 7, como indican estas dieciséis figuras :

Saturno y Marte	4	4	10	10		Júpiter y Marte	4	4	10	10	
Sol	1	7	1	7		Sol	1	7	1	7	

y otras ocho figuras análogas cambiando el Sol por la Luna.

Tercero. Marte y Sol o Marte y Saturno en las casas 1, 4, 7, 10 y Júpiter en cuadratura con Marte. La significación astrológica es la victoria del Rey y de las gentes que estén bajo el influjo de los signos en que se encuentran Sol o Saturno. Las figuras correspondientes son :

Marte	1	1	1	1	4	4	4	4	7	7	7	7	10	10	10	10
Sol	4	7	7	10	7	10	10	1	10	1	1	4	1	4	4	7
Júpiter	10	4	10	4	1	1	7	7	4	4	10	10	7	1	7	1

y otras dieciséis figuras análogas en las que está Saturno en vez de Sol.

Cuarto. Júpiter en las casas 1 ó 7; Saturno en oposición a Júpiter; Marte en la casa 12 y uno de los astros, Sol ó Luna, en la casa 2. El presagio es funesto para la villa que esté bajo el influjo del ascendente o casa 1. Las figuras son cuatro :

Júpiter	1	7		Júpiter	1	7	
Sol	2	2		Luna	2	2	
Saturno	7	1		Saturno	7	1	
Marte	12	12		Marte	12	12	

Quinto. En los tres casos siguientes :

Marte	1	Marte	1	Marte	1
Sol	2	Sol	2	Sol	2
Saturno	7	Júpiter	7	Júpiter	7
Luna	12	Luna	12	Saturno	12

se presagian daños en las villas influidas por los signos que indican desgracia.

Sexto. Cuando se presente una de las cuatro combinaciones :

Júpiter	Júpiter	Marte	Marte		1
Marte	Marte	Júpiter	Júpiter	en las casas	4
Sol	Saturno	Sol	Saturno		10

habrá lucha entre el reinado que esté bajo el signo ocupado por Marte y la gente que esté bajo el signo ocupado por Júpiter y resultarán vencidos los primeros.

Séptimo. Sol en la casa 1 ó en la 7; Marte en una de las tres casas siguientes al Sol y Saturno o Júpiter en oposición a Marte. Lo cual da origen a doce figuras que son :

Sol	1	1	1	7	7	7
Marte	2	3	4	8	9	10
Saturno	8	9	10	2	3	4

y otras seis cambiando Saturno por Júpiter. Significa que el pueblo que está bajo el influjo del signo ocupado por el Sol vencerá a sus enemigos en la lucha.

Octavo. Cuando el Sol esté en las casas 1 ó 7, Saturno o Júpiter en una de las casas 2, 6, 8, 12 y la Cabeza de dragón (Caput) o la Cola de dragón (Cauda) en conjunción con Saturno o Júpiter, se debe interpretar que el signo ocupado por el Sol indica quién vencerá o triunfará de sus enemigos, apoderándose de éstos sin entablar lucha ni batalla. Las figuras correspondientes son treinta y dos, que se forman de este modo :

Sol	1	1	1	1
Saturno y Caput	2	6	8	10

Otras cuatro sustituyendo Saturno por Júpiter.

Otras ocho cambiando en las ocho anteriores Caput por Cauda.

Otras dieciséis, repitiendo las dieciséis anteriores, poniendo Sol en 7, en vez de 1.

CAPÍTULO X. Está dividido en trece subcapítulos sin numerar.

Primero. Marte en la casa 1 ó en la 7; Saturno y Júpiter en aspecto sextil, trino o de oposición en las casas 2, 6, 8 ó 12 y el Sol en conjunción con uno de estos dos últimos planetas. Significa daños y disminución en el poderío del Rey que esté bajo el signo del planeta que indica daño. Las figuras son cuarenta y ocho.

Marte	1	1	1	1	1	1	7	7	7	7	7	7
Sol y Saturno	2	2	2	12	12	8	2	2	2	12	12	8
Júpiter	12	8	6	8	6	6	12	8	6	8	6	6

y análogas figuras para estas otras tres combinaciones :

Marte	||	Marte	||	Marte	||
Saturno	||	Sol y Júpiter	||	Júpiter	||
Sol y Júpiter	||	Saturno	||	Sol y Saturno	||

Segundo. La misma disposición respecto de las casas con estas dos combinaciones :

Marte y Caput	||	Marte y Caput
Júpiter	||	Saturno
Saturno	||	Júpiter

con lo cual forma veinticuatro figuras. La significación astrológica es la misma que en el caso anterior con la modificación de que los enemigos serán de un país lejano.

Tercero. Estudia en este caso un grupo de constelaciones *quemadas* que no significan daños ni matanzas y otro grupo que indica muerte de rey o de gran señor.

Las combinaciones inofensivas son :

Marte || Saturno	Marte || Sol	Marte || Júpiter	Marte || Júpiter	Marte || Sol	Marte || Sol
Júpiter || Sol	Saturno || Saturno	Saturno || Sol	Sol || Saturno	Saturno || Júpiter	Júpiter || Júpiter

en cada una de estas posiciones :

2 || 1 || 3	2 || 1 || 9	2 || 1 || 11	2 || 1 || 5	8 || 1 || 3	8 || 1 || 9	8 || 1 || 11	8 || 1 || 5

o sea, cuarenta y ocho figuras.

Las combinaciones funestas son estas cuatro :

Saturno	12	12	6	6	||
Sol	3	9	3	9	||
Marte	9	3	9	3	||

Cuarto. Estando el Sol en alguna de las casas impares en conjunción con Saturno y en cuadratura con Marte o en conjunción con Júpiter y en cuadratura con Saturno, presagia muerte y destrucción de rey o gran señor, robos y cautiverios. Las figuras son veinticuatro :

Sol y Saturno	1	1	3	3	5	5	7	7	9	9	11	11 ||
Marte	4	10	6	12	8	2	10	4	12	6	2	8 ||

y otras doce análogas con la combinación :

Sol y Júpiter	|
Saturno	|

Quinto. Si se reunen en un mismo signo tres de los planetas superiores y el cuarto planeta se encuentra en signo de igual nombre (estaca o ángulo), la significación astrológica es de gran daño y *entrepieço* en el rey y la gente que esté bajo el signo en que tiene lugar la conjunción. Por excepción, si este signo fuera le ascendente del reinado ocurrirá lo contrario y aumentará su poderío.

El juicio general se modifica en dos casos : 1º Si Marte está en la casa 1 y Júpiter en cuadratura y con mayor influjo, será el mismo pueblo el que se levantará contra el Rey. 2.º Si la Cabeza de dragón se halla en conjunción con Marte en la casa 1, los enemigos serán gente de tierras muy lejanas.

Las figuras son doscientas cuarenta, que se forman combinando cada una de las casas impares (1, 3, 5, 7, 9, 11) con cada una de las otras cinco impares, con lo que resultan treinta combinaciones binarias de casas de orden impar; otras treinta, que se forman combinando cada una de las casas pares (2, 4, 6, 8, 10, 12) con cada una de las otras cinco pares. Y el total de las sesenta combinaciones binarias se aplica sucesivamente a estas cuatro combinaciones de planetas :

Saturno, Júpiter y Marte Sol	Saturno, Júpiter y Sol Marte
Saturno, Marte y Sol Júpiter	Júpiter, Marte y Sol Saturno

Sexto. Júpiter en la casa 1 ó en la 10, Marte en cuadratura con Júpiter y Sol en oposición a Marte, da lugar a cuatro figuras de funesta significación astrológica para el reinado que esté influido por los signos en que se encuentren Marte o Sol. Las figuras son :

Júpiter	1	1	10	10
Sol	4	10	7	1
Marte	10	4	1	7

Séptimo. Si en las figuras anteriores existe además la conjunción de la Cabeza de dragón con Júpiter o con Marte, la significación astrológica es la misma, con la modificación de que sucederá inmediatamente. Hay, pues, ocho figuras :

Júpiter-Caput	1	1	10	10	Júpiter	1	1	10	10
Sol	4	10	7	1	Sol	1	1	7	1
Marte	10	4	1	7	Marte-Caput	10	4	1	7

Octavo. Cuando Júpiter se encuentre en la casa 1 ó en la 7 y la conjunción de los otros tres planetas forme cuadratura, le amenazan al Rey dos peligros, uno por parte de sus caballeros y otro por parte de gente extraña, que le ganará algún territorio. Las figuras son cuatro :

Júpiter	1	1	7	7
Saturno, Marte y Sol	4	10	4	10

Noveno. Estando Júpiter en la casa 1 ó en la 7, Marte en la 3 ó en la 9, Sol en conjunción con cualquiera de los dos anteriores y Saturno en la casa 10, resultan las ocho figuras :

Júpiter y Sol	1	1	7	7		Júpiter	1	1	7	7
Marte	3	9	3	9		Marte y Sol	3	9	3	9
Saturno	10	10	10	10		Saturno	10	10	10	10

que significan que el Rey pondrá en prisión a alguno de sus caballeros, por haber hecho algún daño. La importancia es mayor si el signo en que está Saturno es indicador del reinado.

Décimo. Si uno de los tres planetas superiores está en la casa 10 y la conjunción de los otros dos con el Sol está en cuadratura con el planeta aislado, significa una sublevación en el reino si el signo en que está el planeta sólo es uno de los ángulos en el horóscopo del reinado. Las figuras son estas seis :

Júpiter, Marte y Sol	1	7		Saturno, Marte y Sol	1	4
Saturno	10	10		Júpiter	10	10
Saturno, Júpiter y Sol	1	7
Marte	10	10

Undécimo. Marte en la casa 1 ó en la 10. Júpiter en cuadratura acompañado de Saturno o de Sol. La significación astrológica es de luchas y batallas, con derrota de la gente cuyo ascendente sea el signo en que esté Marte. Las figuras son :

Júpiter y Saturno	4	10	1	7
Marte	1	1	10	10

y otras cuatro cambiando Saturno por Sol.

Duodécimo. Júpiter en la casa 1 ó en la 10, Marte en cuadratura con Júpiter, Sol en oposición a Marte y la Cabeza de dragón con Júpiter, con Marte o con ninguno de los dos. Son, pues, tres casos, que conviene estudiar separadamente.

Primer caso :

Júpiter y Caput	1	1	10	10	||
Marte	4	10	1	7	||
Sol	10	4	7	1	||

Su significación es que los caballeros y los hombres del Rey serán vencidos en tierra extraña.

Segundo caso :

Júpiter	1	1	10	10	||
Marte y Caput	4	10	1	7	||
Sol	10	4	7	1	||

Su significación es que los enemigos vendrán de lejanas tierras, cercarán las villas del Rey y cometerán robos y muertes.

Tercer caso :

Júpiter	1	1	10	10	||
Marte	4	10	1	7	||
Sol	10	4	7	1	||

Su significación es que habrá una sangrienta sublevación contra el Rey .

Décimotercero. Sol en la casa 1 ó en la 10 y Marte en cuadratura con el Sol. Si Marte se encuentra en conjunción con Saturno o Júpiter supone gran desventura para el Rey. Si Marte no está acompañado de dichos planetas la desventura se refiere a algún gran personaje del reino. Las figuras son doce :

Sol	1	1	10	10	||
Marte y Saturno	4	10	1	7	||

y las análogas con las combinaciones :

Sol |	Sol |
Marte y Júpiter |	Marte |

CAPÍTULO XI. Se limita en este capítulo a hacer unas indicaciones de carácter puramente astronómico, como base para futuras interpretaciones astrológicas. Afirma que las tablas astronómicas indican que el Sol entra en cada signo del Zodiaco el día 23, pero que por la variación de los puntos equinocciales y solsticiales no se le adjudica toda su influencia astrológica hasta el día 27.

Respecto a los planetas Saturno, Júpiter y Marte, cuya entrada en los signos está calculada en las tablas, expresa que su acción se amplía en seis grados y en cambio la Cabeza de dragón no

ejerce influencia hasta no haber disminuido otros seis grados en su declinación.

Alude muy ligeramente a la diversidad de los diámetros de los planetas y dice que la Cabeza de dragón no tiene diámetro apreciable.

CAPÍTULO XII. Reanuda el estudio de las *constelaciones* con el caso de existir una conjunción de los tres planetas superiores en cualquiera de las casas impares y estar el Sol con la Cabeza de dragón en cuadratura con la citada conjunción. Las figuras que resultan son estas doce :

Saturno, Júpiter y Marte	1	1	3	3	5	5	7	7	9	3	11	11
Sol y Caput	4	10	6	11	8	2	10	4	12	6	2	8

Significa que aparecerán en el cielo cometas, estrellas con cola y fuegos o meteoros ígneos.

CAPÍTULO XIII. Las figuras formadas estando el Sol en la casa 7, uno de los tres planetas superiores en cuadratura y los otros dos planetas en las casas 2 y 12 ó 6 y 8 tienen una significación de desgracia o muerte. Son veinticuatro figuras que pueden distribuirse en tres grupos; el primero es :

Sol	7	7	7	7	7	7	7	7
Saturno	4	4	4	4	10	10	10	10
Marte	2	12	6	8	2	12	6	8
Júpiter	12	2	8	6	12	2	8	6

Los otros dos grupos se obtienen cambiando los nombres de los planetas y colocándolos en esta forma :

Sol		Sol
Júpiter	o bien	Marte
Saturno		Saturno
Marte		Júpiter

Hace notar ahora que, para poder predecir el momento en que ocurrirán todos los juicios anteriormente expuestos, es necesario observar el tiempo en que la Cabeza de dragón llegue a una casa determinada. En general, los sucesos desgraciados ocurrirán cuando Caput llegue a la casa 1 ó 7 y los sucesos favorables, cuando llegue a la casa 4 ó 10.

Son también figuras que significan lides y matanzas las siguientes:

Sol	1	1	4	4	7	7	10	10	||
Marte	3	3	6	6	9	9	12	12	||
Saturno	7	9	10	12	1	3	4	6	||

y otras ocho obtenidas poniendo Júpiter en vez de Saturno. Dice que, por excepción, la figura no resulta funesta, si el Sol está en la casa 1 e influye sobre el reinado.

Todavía en este mismo capítulo incluye dos figuras, que son

Marte	4	Marte	4
Sol y Saturno	7	Sol y Júpiter	7

que además de indicar guerras adversas, significan gran sequía.

CAPÍTULO XIV. Uno cualquiera de tres planetas superiores (ya se sabe que alude a Sol, Marte, Júpiter o Saturno) que está en cuadratura con el cuarto planeta y éste se encuentra en la casa 1 si es Marte, en la casa 7 si es Sol, en la casa 10 si es Saturno o en la casa 4 si es Júpiter, indica un presagio funesto en el reinado que esté bajo el influjo del signo en que se encuentra el planeta más determinado.

Las figuras correspondientes son éstas:

Marte	1	1 ||	Marte	1	1 ||	Marte	1	1 ||
Saturno	4	10 ||	Júpiter	4	10 ||	Sol	4	10 ||
Sol	7	7 ||	Sol	7	7 ||	Sol	7	7 ||
Saturno	4	10 ||	Júpiter	4	10 ||	Marte	4	10 ||
Saturno	10	10 ||	Saturno	10	10 ||	Saturno	10	10 ||
Júpiter	1	7 ||	Marte	1	7 ||	Sol	1	7 ||
Júpiter	4	4 ||	Júpiter	4	4 ||	Júpiter	4	4 ||
Saturno	1	7 ||	Marte	1	7 ||	Sol	1	7 ||

En cambio las figuras que se forman con Marte en la casa 10 y otros dos planetas juntos en la casa 2 ó en la casa 8, tienen significación favorable al reinado que esté bajo el signo de la conjunción.

Y del mismo modo estarán sometidos los enemigos mientras duren las figuras que se obtienen con Marte o Sol en las casas 2, 8, 12 ó 6; uno de los planetas Júpiter o Saturno en las casas 10 ó 7 y el otro en las casas 3 ó 9. Resultan según estas combinaciones

sesenta y cuatro figuras, que fácilmente podrá reconstruir el lector que haya tenido interés y paciencia para llegar a este capítulo. En adelante indicaré solamente la disposición de los elementos astronómicos para no fatigar a los lectores.

CAPÍTULO XV. Conjunción de dos planetas en las casas 1, 4, 7 ó 10 y los otros dos planetas cercando a la casa de la conjunción, sea en los signos anterior y posterior o en las oposiciones de éstos, pero a la vez en los laterales o a la vez en las oposiciones. Estas figuras, que en total son noventa y seis indican grandes lides y batallas, cerco de villas y fuertes matanzas con la derrota de los pueblos influidos por el signo que ocupe la conjunción o su cuadrante.

CAPÍTULO XVI. Conjunción de Saturno y Sol en la casa 7. Los planetas Júpiter y Marte, juntos o separados, en las casas 5 u 11. Se obtienen cuatro figuras que significan el mismo desastre anterior, aunque con escasa mortandad.

Hace la observación de que si la conjunción de Saturno y Sol fuese en la casa 1 en lugar de la casa 7, el presagio astrológico es favorable al Rey y al pueblo.

CAPÍTULO XVII. Presenta en este capítulo cinco grupos de constelaciones que denomina *quemantes;* son los siguientes :

Sol en la casa 7. Saturno con Júpiter en la casa 1. Marte en las casas 12 ó 7. De influencia funesta bajo el signo en que esté la conjunción de Saturno.

Sol en la casa 7. Saturno con Júpiter en la casa 1. Marte en las casas 3 ó 9. Significa enfermedades y epidemias.

Sol en las casas 3 ó 9. Saturno y Marte en conjunción o en oposición con Sol. Júpiter en la casa 10. También pueden estar Saturno y Marte en la casa 7 ó uno en la 7 y otro en la 1. Indican estas figuras que el Rey se ensañará contra sus vasallos.

Sol y Marte en la casa 7. Júpiter, que es enemigo de Marte, en la casa 1 (oposición). Saturno, que es enemigo del Sol, en cuadratura con éste. Resultan dos figuras de mal presagio para el Rey y el pueblo que esté bajo el signo de la conjunción.

La sustitución de la Cabeza de dragón por Saturno en las dos figuras últimas no es de mal presagio para el pueblo, aunque si lo es para el Rey.

CAPITULO XVIII. Dos de los planetas Saturno, Júpiter y

Marte, están en conjunción en una de las casas 1, 4, 7, 10; el tercer planeta en oposición y el Sol en cuadratura. Esto da lugar a 24 figuras que señalan lides y guerras con pocas matanzas en el pueblo que esté bajo el influjo del signo de la conjunción.

CAPÍTULO XIX. Presenta tres casos diversos :

1º Saturno en una casa de las impares. Sol y Júpiter en oposición a Saturno. Marte en una de las restantes casas impares. El juicio astrológico es muy favorable bajo el influjo del signo en que esté la conjunción de Sol y Júpiter. Las figuras son 24.

2º Las mismas posiciones para Saturno, Júpiter y Marte, pero el Sol en conjunción con Saturno. Pronostica desgracias.

3º Sol y Júpiter en la casa 1. Saturno y Marte en oposición mutua en las restantes casas impares. Las cuatro figuras que se obtienen indican conquista de villas y castillos.

CAPÍTULO XX. Sol y Saturno en la casa 7. Júpiter en la casa 3 ó en la 9. Marte en la 11 ó en la 5. Esta constelación pronostica muerte del Rey con engaño y traición.

CAPÍTULO XXI. La base de este capítulo es que Saturno y Júpiter estén en oposición ocupando una casa cualquiera y la opuesta. Si el Sol está con Júpiter es buen presagio. Si el Sol está con Saturno es mal presagio. Si el Sol está con Marte tres casas detrás de Júpiter indica bienestar general. Si el Sol va solo detrás de los otros tres aventura fuertes lides y matanzas.

CAPÍTULO XXII. Expone varios grupos de constelaciones.

1º Sol en la casa 1. Marte en la casa 4 ó en la 10. Júpiter o Saturno en casa par, sin estar en la de Marte. Resultan veinte figuras que vaticinan la destrucción del Rey bajo el signo en que se halle el Sol.

2º Sol en la casa 10. Marte en cuadratura. Júpiter o Saturno en casa impar sin estar en la de Marte. Resultan veinte figuras de buen augurio para el Rey.

3º Si en todas las figuras anteriores se sustituye Júpiter por Marte y Marte por Júpiter se interpretará como señal de paz y bienestar.

4º Sol en cualquier signo. Marte en cuadratura. Saturno y Júpiter juntos en una casa de igual paridad que la que ocupa Marte. Se obtienen así 120 figuras de un presagio fatídico, con vencimiento y cautiverio del Rey y la gente que se halle bajo el influjo del signo en que el Sol se encuentre.

CAPÍTULO XXIII. Estando el Sol en una cualquiera de las doce casas, dos planetas juntos en oposición con el Sol y el planeta restante en el tercer signo siguiente al Sol o siguiente a Marte, se forman setenta y dos constelaciones, que presagian grandes males y guerras bajo el signo de la conjunción.

Otro grupo de constelaciones de igual significación astrológica se forma con la conjunción de Marte y Sol en cualquier signo, Júpiter en el quinto signo siguiente y Saturno en el noveno. Se obtienen 12 figuras.

CAPÍTULO XXIV. Cuando Saturno se encuentra en Aries o Escorpión, en cualquier casa del cielo y la conjunción Sol-Júpiter se encuentra en el quinto signo a partir de Saturno, quiere decir, Leo o Piscis, indica gran sequía, carestía de subsistencias y hambre en toda la Tierra y especialmente en el señorío del signo en que esté Saturno. Resultan 24 figuras.

El mismo significado, con mayor intensidad, se deduce si en las figuras anteriores se añade que Marte está en cuadratura con Júpiter.

CAPÍTULO XXV. Si Júpiter y Saturno se encuentran en Aries o Escorpión, en cualquier casa del cielo, Marte en signo terreo (Tauro, Virgo, Capricornio), Sol en signo acueo (Cáncer, Escorpión, Piscis) y la Cabeza de dragón en signo terreo, se forma constelación que anuncia lluvias beneficiosas, abundancia de cosechas, aumento de riqueza y paz entre los hombres. En el libro pone el autor 648 figuras en 72 grupos de 9 : la mitad corresponden al caso de Aries y la otra mitad al caso de Escorpión.

CAPÍTULO XXVI. De todas las constelaciones anteriores puede deducirse el precio que tendrá el pan en cada mes del año. Para ello basta observar : 1º cuál es el señor del signo en que se verifica la conjunción; 2º en qué signo está cada mes el señor de aquel signo; 3º contar los signos que haya entre el signo ocupado por el señor y el Sol. Hechas estas observaciones ya puede decirse que el número de signos contados hasta el Sol son los maravedises y los grados que no completan un signo son las partes de maravedí. Esta cuenta se aplica lo mismo en las regiones en que por un maravedí se dan varias medidas de pan, y en este caso, el número de signos indica el número de medidas de pan en lugar del número de maravedís.

CAPÍTULO XXVII. Este capítulo indica que tanto los signos

como los planetas expresan fortuna o infortunio: cuando se reunen se aumenta su influencia y cuando se hallan separados, se disminuye.

CAPÍTULO XXVIII. Cuando Saturno está en la casa 6, el Sol en la 3, Júpiter o Marte en la 11 y la Cabeza de dragón en la 1 se forma una constelación que presagia muchas lluvias, muchas cosechas, aguaceros que causarán daños, abundancia de víveres en el verano y victoria del rey sobre sus enemigos en el pueblo que corresponda al signo en que se halle el Sol. Las dos figuras que resultan dependen de considerar Júpiter o Marte.

La intensidad de las lluvias dependa de la condición de los signos en que se hallen los planetas. Si todos o la mayoría están en signos acueos, las lluvias serán extraordinarias y prolongadas; si estuvieran en signos terreos, las lluvias serían menos abundantes; si los planetas estuvieran repartidos en signos acueos y terreos, las lluvias serían muy provechosas; y si estuvieran en signos aereos o igneos, habría muchas nubes pero pocas lluvias.

Finalmente, para saber precisar el tiempo en que acaecerán las lluvias se calcula cuándo estará la Luna en el signo de la conjunción de los planetas o en la cuadratura de dicho signo y en ese tiempo será la lluvia «si Dios quiere».

CAPÍTULO XXIX. Está dividido en tres subcapítulos.

I. El sol está situado en la casa 1 y el signo correspondiente es el ascendente del rey; Saturno está en posición de trino con el Sol; Júpiter y Marte juntos se hallan en otro trino también con el Sol. Esta constelación, que da lugar a 2 figuras, significa que los enemigos del rey se sublevarán y causarán daños.

II. Hace observar que las casas impares son favorables al rey cuando en ellas están los signos afectos al rey o al Sol y que por el contrario son adversas las casas de lugar par.

III. El Sol en la casa 1 ó en la 7. Marte y Júpiter juntos en cuadratura con el Sol. Produce 4 figuras. Significa destrucción y muerte probable del rey; presagia la muerte segura si el signo en que se encuentra el Sol es el ascendente del rey.

CAPÍTULO XXX. Indica que los sucesos ocurren en los países orientales u occidentales según que los signos sean significadores de unos o de otros.

CAPÍTULO XXXI. La enfermedad, prisión o miedo terminará cuando exista conjunción de planetas en el signo in-

fortunado del día en que ocurrió el accidente de que se trate.

Se enriquecerá una persona cuando se verifique una conjunción de varios planetas en el signo que fuera el ascendente en el día de su nacimiento.

Podrá augurarse alguna desgracia cuando en el ascendente del nacimiento de una persona o en su casa 7 hubiera algún planeta *pesado*, es decir Saturno, Júpiter, Marte o Sol, y vuelva a encontrarse en el mismo signo.

Se presagia la muerte de una persona cuando el Sol esté en el signo del ascendente de su nacimiento o en su casa 7 y Marte con Saturno o con Júpiter en cuadratura con respecto al Sol. Si en esta constelación se sustituye el Sol por Saturno o Júpiter, indica desgracia pero no muerte.

Una persona obtendrá satisfacciones o alegrías cuando se reunan tres planetas superiores en el signo de su ascendente o en su casa 7 y el cuarto planeta superior se halle en signo enemigo. Si el cuarto planeta no está en signo enemigo significaría desgracia, pero si el Sol está con los otros planetas vuelve a ser señal de buena suerte.

Hace observar que se consideran signos fuertemente enemigos los que se encuentran a partir de otro en su casa 4, 10, 7, 2 y 12. Que son débilmente enemigos si están en su casa 8 y 6. En cambio son signos amigos los que a partir de un signo se hallan en su casa 3, 5, 9 y 11.

La terminación de la disputa (*varaia*), desacuerdo o pleito entre hombre y mujer se puede predecir en los casos siguientes: Si hay 3 planetas en el signo del ascendente del hombre o en el signo del ascendente del comienzo de la cuestión, vencerá el hombre. Si hay 3 planetas en el signo del ascendente de la mujer o en la casa 7 del comienzo de la cuestión, vencerá la mujer. Si hay 3 planetas en la casa 3 a partir del ascendente del hombre o del comienzo de la cuestión, habrá partición de bienes sin que pierda el hombre. Si sólo hay 2 planetas en las circunstancias anteriores y los otros dos en signos enemigos, se recrudecerá la cuestión, pero terminará satisfactoriamente para los dos.

Para prejuzgar la pelea o reyerta entre dos hombres se tiene en cuenta que el significado en estaca (casa impar) vence al significado en ángulo (casa par); si los signos están a la vez en estacas o en ángulos vencen los signos por analogía con el signo en que

haya conjunción de planetas y si hubiera empate no vencería ninguno.

CAPÍTULO XXXII. Para saber si un hombre saldrá afortunado en una empresa, se averigua qué signo ocupa el lugar 9 en el horóscopo de su nacimiento y se coloca dicho signo en el ascendente del comienzo de la empresa. La fortuna que se quiere predecir será efectiva si se cumple una de las 48 figuras que se forman con los datos siguientes : Sol o Júpiter o ambos en la casa 1, Saturno y Marte juntos o separados en las casas amigas 3, 5, 9, 11.

CAPÍTULO XXXIII. El tiempo o momento en que se realizará la prisión será cuando se forme una de las constelaciones siguientes a condición de que la casa 1 ó 7 esté ocupada por el mismo planeta que había en la casa 12 ó 6 de la constelación que indicó que sería preso. Uno de los cuatro planetas, Saturno, Júpiter, Marte, Sol en la casa 1 ó en la 7 y los otros tres en conjunción en signos enemigos, que para la casa 1 son las casas 4, 7, 10, 12 y para la casa 7 son las casas 1, 4, 6, 10. Resultan 32 figuras.

CAPÍTULO XXXIV. El tiempo o momento en que será puesto en libertad, se prejuzga de una manera análoga cambiando las casas en esta forma : uno de los cuatro planetas en la casa 6 ó 12 y los otros tres en conjunción, en signos amigos, que para la casa 6 son las casas 2, 4, 8, 10 y para la casa 12 son las casas 2, 4, 8, 10. También resultan 32 figuras.

CAPÍTULO XXXV. Un hombre recibirá dignidad o señorío si en la casa 10 de su nacimiento estuvieran Júpiter o Sol. Esto supuesto, obtendrá el beneficio cuando se junten Júpiter y Sol en la casa 10 y los otros dos planetas Saturno y Marte juntos o separados estén en signos amigos que son las casas 2, 6, 8, 12. Se forman 16 figuras.

CAPÍTULO XXXVI. Para averiguar la existencia de una destitución de dignidad o pérdida de señorío se observa qué planeta estaba en el ascendente o en la casa 10 al comienzo de la dignidad o señorío. Cuando dicho planeta ocupe la casa 12 ó la casa 6 y los otros tres planetas juntos o separados se encuentren en las casas de signos enemigos, ocurrirá la pérdida con motivo de acusaciones.

Las acusaciones serán ciertas si los tres últimos planetas están en conjunción. Las acusaciones serán en parte verdaderas y en

parte falsas si hay conjunción de dos planetas. Las acusaciones serán falsas si los tres planetas están en tres casas distintas.

Las casas enemigas de la 12 son la 3, la 6, la 9 y la 11. Y las casas enemigas de la 6 son la 3, la 5, la 9 y la 12.

Para el caso de acusaciones ciertas resultan 32 figuras.

Para el caso de acusaciones verdaderas y falsas resultan 264 figuras.

Para el caso de acusaciones falsas resultan 192 figuras.

CAPÍTULO XXXVII. Si la mayoría de los planetas están en casas de ángulo al empezar la sublevación, vencerán los sublevados o « salidos ». En otro caso vencerá el rey.

CAPÍTULO XXXVIII. Las constelaciones que indican el casamiento son dos : la primera cuando Sol está en el ascendente del nacimiento del hombre y Júpiter en la casa 11 y la segunda cuando la conjunción de Saturno y Marte se encuentra sustituyendo al Sol en la constelación anterior.

Existe además la combinación : Saturno en la casa 2, Júpiter en la casa 7 y Sol en la casa 11, que quiere decir que el casamiento no será legítimo.

CAPÍTULO XXXIX. Este capítulo modifica y amplía el juicio expuesto en el último párrafo del capítulo XXXI. También da nuevas normas acerca del contenido en el capítulo XXVI.

Contienda entre dos hombres. Para saber quién vencerá se forma el horóscopo del nacimiento de ambos, se observa cuáles son los planetas de mayor influencia en cada uno, se forma el horóscopo en el momento de la contienda y se asegura que vencerá aquel cuyo horóscopo de nacimiento se asemeje más al horóscopo de la contienda. En el caso de empate, es decir, que haya dos planetas como en el primero y dos como en el segundo, decide la victoria el Sol.

El tiempo en que terminará la contienda lo indica la Luna : se verificará cuando ésta se ponga en conjunción con el planeta o planetas que señalan la victoria.

Nuevas denominaciones de los planetas. Los planetas Saturno, Júpiter, Marte y Sol se llaman *pesados*. Entre éstos se denominan *fijos* a Saturno y Júpiter; también se asimila a los planetas fijos la Cabeza de dragón. Los signos del Zodiaco llamados fijos son Tauro, Leo, Escorpión y Acuario.

Juicios astrólogicos para elegir un momento favorable. Las huestes

que salgan a luchar con enemigos deben hacerlo cuando la Luna se encuentre en casa de ángulo y en signo fijo y los planetas o su mayoría en signos favorables. El hombre que salga a luchar o solamente a ponerse en camino debe hacerlo cuando Mercurio se encuentre en la región hacia donde el hombre se dirija : estas regiones pueden ser oriental, septentrional, occidental o medio día.

Comprobación de la verdad o la mentira. Se forma el horóscopo de la hora de la cuestión que se consulta : si la Luna se encuentra con algún planeta, tal cuestión es verdad; si la Luna está separada de los planetas, la cuestión es falsa.

Prejuicio acerca del precio del pan en cada mes. Se observa en qué signo está el Sol en dicho mes. Se busca a qué planeta corresponde ese signo. Se ve cuántos signos o grados hay entre dicho planeta y el Sol. Este número será el del precio del pan.

Otro modo de averiguarlo consiste en observar cuándo entra el Sol en la Cabeza de Capricornio, contar los signos y grados que en ese momento haya desde el Sol a la Luna y éste número indicará el precio del pan.

Nuevo juicio sobre contiendas y batallas. Para saber quién vencerá se observa dónde está Mercurio. Los que luchen de frente a la región en que esté Mercurio vencerán y los que estén de espaldas serán vencidos.

Nuevos juicios para elegir momento favorable. El hombre que salga a luchar debe hacerlo en la hora de Marte o en la de Saturno, cuando la Luna esté en Sagitario, cuando la Luna esté hacia Oriente y cuando el ascendente sea un signo favorable o significador. Hace observar que el signo Virgo es siempre adverso, el de Géminis favorable al rey y los leales del rey.

El rey que se pone en camino con mucho acompañamiento debe hacerlo cuando haya dos o tres planetas en el signo de su ascendente, y si se pone en camino con poco acompañamiento, debe hacerlo cuando los planetas estén en la casa 7. Los que se pongan en camino por orden del rey deben hacerlo cuando haya dos o tres planetas en la casa 2 ó en la casa 11.

Algunos juicios por influjo de la Cabeza de dragón. En las constelaciones que indican luchas o batallas, la Cabeza de dragón significa que serán grandes y fuertes cuando se halle alejada de los planetas y en casa de condición distinta con relación a su número par o impar.

La Cabeza de dragón señala que vencerá la gente que esté bajo la significación del signo en que aquélla se halle.

Cuando existen dos planetas en la casa 10 y otros dos en la casa 1 ó en la 7, la Cabeza de dragón indica la desgracia de la región significada por el signo en que se encuentre la Cabeza.

CAPÍTULO XL. Marte en la casa 1 ó en la 7, Júpiter en cuadratura con Marte y la conjunción de Saturno y Sol en cuadratura con Júpiter o con Marte. Esta constelación presagia fuertes matanzas, graves daños y derrota en la lucha si el signo en que esté la conjunción Saturno y Sol es uno de los significadores del enemigo. Resultan 8 figuras.

CAPÍTULO XLI. Cuando Saturno esté en la casa 7, Júpiter en la casa 10 ó en la 4, Marte en la 3 ó la 9 y Sol en la 11 ó la 5, el rey saldrá a combatir a los enemigos y los vencerá completamente cuando el Sol llegue a la casa 2; además se asegurará la paz para en adelante. Hay 8 figuras.

CAPÍTULO XLII. Sucederá lo que se indica en el título si Saturno está en la casa 7, Marte en la casa 1 ó en la 7, Júpiter en la 3 ó en la 9, la Cabeza de dragón en la 5 ó en la 11 y Sol en la 4 ó en la 10, ó sea en cuadratura con Marte. Resultan 16 figuras.

CAPÍTULO XLIII. Para saber si a una persona le van a ocurrir desgracias por heridas, accidentes, graves enfermedades o muerte, se observa el signo del ascendente en el horóscopo de su nacimiento. Si Saturno, Marte, Sol o la Cola del dragón, que son infortunados, están en cuadratura del signo del ascendente y el señor de este signo está en las casas 2, 6, 8 ó 12 ó en conjunción con varios planetas, puede asegurarse alguna desgracia.

Si la Luna entra en el ascendente de la persona o en su casa 7, le ocurrirá grave enfermedad o muerte. Si la cuadratura de los astros infortunados fuese por detrás, es decir, contando en sentido inverso al movimiento celeste, la desgracia será producida por heridas, llagas o accidente. Y si hubiera una cuadratura por delante y otra por detrás, la muerte será indudable.

CAPÍTULO XLIV. El infortunio que significa Saturno se disminuye o se neutraliza cuando Júpiter está en trino, cuadratura u otra situación o aspecto favorable.

El infortunio que significa Marte lo disminuye o neutraliza Venus de la misma manera.

Mercurio es un planeta que cuando está visible permite hacer

diversos augurios : si tiene color rojizo significa disputas, contrariedades y derramamiento de sangre; si tiene color amarillento presagia sequía y carestía de víveres; si tiene color verdoso, todo lo contrario; si aparece muy oscuro anuncia tristezas y enfermedades. También predice el resultado de las gentes que se ponen en camino para negocios o luchas : saldrán triunfantes los que caminen de cara a Mercurio y fracasarán los que marchen en dirección opuesta.

La fortuna que siempre indica la presencia de Júpiter se vé reforzada cuando con él está la Cabeza del dragón.

La fortuna que siempre indica la presencia de Venus se vé también aumentada si la Cabeza del dragón se encuentra en trino o en sextil y se aumenta todavía más si esta posición ocurre en el signo de Géminis o de Virgo.

CAPÍTULO XLV. Sol con Saturno o con Marte en casa par y los otros dos planetas, Júpiter y Marte o Júpiter y Saturno, separados, pero ambos en cuadratura, una por delante y otra por detrás, significa lluvias abundantes.

La mayor fuerza de las lluvias y aguaceros será cuando la Luna entre en el signo de la conjunción o en su casa 7.

Si los signos de la constelación significan daños y perjuicios, en invierno se producirán por nieves y heladas y en verano por tormentas con piedra o granizo. Los daños serán mayores en la región a que se refiera el signo de la conjunción.

Inserta las 48 figuras correspondientes y añade después que si Júpiter se encuentra en sustitución de Saturno o de Marte, las lluvias serán beneficiosas.

CAPÍTULO XLVI. Sol en la casa 1, Júpiter en conjunción o en oposición y Saturno con Marte en trino o sextil con respecto al Sol significa buena fortuna para el rey. Se forman 8 figuras.

CAPÍTULO XLVII. Sol con Marte en la casa 7, Saturno o Júpiter en la casa 1 y la Cabeza del dragón en la 4 ó en la 10 significa desgracias y perjuicios para el rey, si el signo de la conjunción es significador del rey. En cambio si este signo es significador de los enemigos, para éstos será la desgracia y el infortunio. Resultan 4 figuras.

CAPÍTULO XLVIII. Sol con uno de los planetas Saturno, Júpiter o Marte en una de las casas « masculinas », que son las estacas o impares, la conjunción de los otros dos planetas que

quedan en la casa impar siguiente y la Cabeza del dragón en la casa par que sigue a la anterior. Esta constelación, que da lugar a 18 figuras, prejuzga que el rey triunfará sobre sus enemigos mediante tratos y convenios sin recurrir a la lucha y haciéndoles bien.

CAPÍTULO IL. Sol en la casa 7, Júpiter en casa impar, que puede ser también la 7,y Marte con la Cola del dragón en la casa 5 ó en la 11. Si el signo en que estuviera el Sol fuese el ascendente del rey o su casa 10 ó el ascendente del reinado o su casa 10, la constelación indica la muerte del rey a traición. Resultan 12 figuras.

Si se cambian las casas impares por casas « femeninas » o de lugar par, el juicio astrológico es muy distinto puesto que indica desgracias y muertes en los hombres viles, malvados, usurpadores y encumbrados injustamente.

Cuando Sol está con Saturno o Júpiter en la casa 7, el planeta de los citados que no está con el Sol en la casa 10 y Marte con la Cola del dragón en la casa 3 ó en la 9, se observa el signo de la conjunción del Sol; si este signo fuera significador del rey, de la ciudad o del reinado, la constelación indica el asesinato del rey y daños y matanzas en el pueblo. En el caso de no ser el rey asesinado, sufrirá una gran desgracia. Se forman 4 figuras.

Cuando Sol esté en la casa 1, en la 5 ó en la 11 y Marte en la 3, en la 7 ó en la 9, anuncia guerra en la cual vencerán los de la región que esté bajo el influjo del signo en que se encuentra el Sol.

CAPÍTULO L. Saturno en las casas 1, 3 u 11, Júpiter en oposición, Marte en cuadratura, Sol en oposición a Marte y por último Venus en trino con Saturno o Júpiter. Esta constelación da lugar a 12 figuras que significan disputas, perjuicios y muertes entre los enemigos del rey.

CAPÍTULO LI. Cuando Sol está en la casa 1 ó en la 7, Marte en cuadratura, Saturno con Júpiter en casa impar que no sea la 1 ni la 7 y Venus en cuadratura con esta conjunción de Saturno y Júpiter, el juicio astrológico presagia una guerra sangrienta, el triunfo de los enemigos, la muerte del rey y la pérdida del reino. Este juicio fatídico es más seguro si el signo en que se halle el Sol fuera el ascendente del rey o del reinado o la casa 10. Se obtienen 32 figuras.

CAPÍTULO LII. Si se encuentra Sol en la casa 1, Marte en cuadratura, o sea en las casas 4 ó 10 y la tripie conjunción de Sa-

turno, Júpiter y Cabeza de dragón en casa impar, que no sea la 1, el rey tomará graves determinaciones con sus aportellados a quienes destituirá y algunos de ellos morirán. Se forman 10 figuras.

Esta misma constelación presagia gran fortuna para el rey si la conjunción triple está en signo significador del rey. Y cuando esta conjunción exista en un signo significador de los enemigos del rey, indica que morirá el caudillo de los enemigos y entrará la desgracia en éstos.

CAPÍTULO LIII. Sol con Marte en la casa 1, Júpiter en cuadratura y Saturno con Cabeza de dragón en la casa 3 ó en la 9, significa el cerco o sitio de una villa o castillo que se halle bajo el influjo del signo en que esté la conjunción de Sol y Marte. El triunfo será para los sitiados. Se forman 4 figuras.

CAPÍTULO LIV. Sol, Saturno y Marte en conjunción triple ocupando una de las casas impares y Júpiter con Cabeza del dragón en cuadratura significa también el cerco de una villa o castillo que se halle bajo el influjo del signo en que esté la triple conjunción o su casa 10, pero el triunfo será de los sitiadores. Resultan 12 figuras.

CAPÍTULO LV. Cuando Marte y Cabeza de dragón estén juntos en la casa 3 y Sol con Saturno o con Júpiter en cuadratura indica que se ha de entablar batalla entre el rey y sus enemigos, y que vencerán éstos. El momento más culminante de la lucha será en el tiempo en que esté la Luna en la casa 1 ó en la 7. Se obtienen 8 figuras, teniendo en cuenta las posiciones de la Luna.

CAPÍTULO LVI. Saturno en la casa 1, Júpiter en la casa 7, Marte en la casa 12 ó en la 6 y Sol en la casa 2 ó en la 8 significa desgracias, luchas, muertes y pérdidas materiales en la villa, pueblo o castillo que se halle bajo el influjo del signo en que esté Saturno. Hay 4 figuras.

CAPÍTULO LVII. Cuando los planetas más influyentes sean los que corresponden a los signos acueos y a la vez se encuentren en estos signos, el año será de cosechas abundantes, especialmente en tierras de ribera, habrá lluvias provechosas y abundantes, aunque causarán algún daño por el crecimiento de los ríos y las inundaciones de las vegas.

Las situaciones análogas en los signos terreos indican año abundante en viandas, pan, mieses y vegetales, con excepción

de los árboles frutales; en los hombres habrá enfermedades que producen melancolía.

Si se trata de signos aereos la significación es de sequía y escasez en terrenos bajos, pérdida de cosechas de mies y vegetales, buena cosecha en los árboles, menos en nogales y olivos, y buen año en los montes y regiones altas. Entre los hombres habrá enfermedades de parálisis, enemistades y malas pasiones.

Cuando la disposición análoga de los planetas se refiera a los signos igneos, el año será de hambre y sequía en general, serán malas todas las cosechas y, entre los hombres, habrá enfermedades de garganta y pulmones, epidemias y mortandad.

Si los planetas significadores estuvieran repartidos en signos acueos y terreos será un año de gran abundancia y por lo tanto baratura [rafeçedumne] de víveres.

Si están en signos aereos e igneos, habrá escasez de aguas, serán malas las cosechas, se dañarán los árboles, a excepción de nogales, olivos, encinas y robles, caerán rayos y habrá epidemias entre los hombres; las regiones de monte y altura sufrirán más los perjuicios.

Si están repartidos en otros signos se deduce la significación astrológica de la reunión de las significaciones de cada uno.

Debe tenerse en cuenta que al estar juntos dos planetas en un mismo signo tiene más influencia el que va a salir que el que acaba de entrar.

(Véase el capítulo LX en que amplía este asunto.)

CAPÍTULO LVIII. Para establecer juicios astrológicos acerca de la muerte o desgracia de una persona se atiende al horóscopo de su nacimiento, se observa cuál es el planeta de mayor influencia y se sigue la marcha de este planeta hasta que llegue a la casa 1, que es el ascendente. Si uno de los planetas que indican muerte, que son Saturno y Marte, estuvieran en cuadratura, es decir, en la casa 4 ó en la 10, entonces ocurrirá la muerte.

También puede ser señal de muerte que el planeta influyente esté en la casa 7 y Saturno o Marte en cuadratura.

La situación de la cuadratura modifica los presagios en esta forma : I. La cuadratura por delante respecto de la casa 1, indica la muerte con seguridad. II. La cuadratura por detrás respecto de la casa 1, significa llagas, enfermedades o lesiones en el cuerpo, que pueden no causar la muerte. III. La cuadratura por delante

respecto de la casa 7, tiene la misma significación anterior. IV. La cuadratura por detrás respecto de la casa 7, augura desgracias e infortunios del haber o capital sin relación con la salud.

Por último, cuando un planeta nefasto aparece en el horóscopo del nacimiento entre las casas 1 y 10 indica enfermedades o accidentes corporales y cuando aparece entre las casas 1 y 4 significa desgracias por dinero.

CAPÍTULO LIX. Este es el capítulo más interesante del libro con relación a España, y con él se demuestra el interés que debió tener Alfonso el Sabio para que el libro resultara de utilidad práctica, puesto que lo añaden los traductores haciendo la observación de que los datos consignados respecto a las villas de España « en que vivimos », son los que más « habemos menester ».

Comienza por establecer la influencia, poder o señorío de los signos del Zodiaco sobre las regiones españolas, dando por supuesto el conocimiento de la distribución de los diversos planetas en los signos del Zodiaco.

Los grados asignados a Venus en el signo de Virgo ejercen poder sobre Córdoba y sus términos. [Son los grados 8 a 13].

Los grados asignados a Júpiter en el signo de Cáncer ejercen poder sobre Sevilla, Cádiz y sus términos. [Son los grados 7 a 13].

Los grados asignados a Marte en el signo de León ejercen poder sobre Murcia, Valencia, Barcelona y sus términos. [Son los grados 26 a 30].

Los asignados a Venus en el signo de Libra ejercen poder sobre Zaragoza y sus términos. [Son los grados 7 a 11].

Los asignados a Júpiter en Tauro, sobre Toledo y sus términos. [Son los grados 16 a 22].

Los asignados a Marte en Virgo, sobre Tortosa y sus términos. [Son los grados 19 a 24].

Los asignados a Mercurio en Sagitario, sobre Santa María de Albarracín y sus términos. [Son los grados 15 a 19].

Establece después el poderío de los planetas sobre las regiones españolas, según la mansión o porción del cielo en que se encuentran aquéllos. Dice que esta distribución la toma de los sabios antiguos, y es la que sigue :

El Sol, cuando está en las mansiones Annath, Annacra, Algafr y Çaadaddebe, ejerce su poder sobre Barcelona y sus términos.

La Luna y Venus, en las mansiones Albotaym, Attarf, Azebene

y Caaddebolah, ejercen su poder sobre Mérida y todo el Algarb. [Actualmente sería Extremadura, Huelva y todo el sur de Portugal hasta los términos de Lisboa].

Marte y Mercurio, en las mansiones Açoraya, Algebah, Alichil y Çaadçood, ejercen su poder sobre Murcia, Valencia y sus términos.

La Luna y Mercurio, en las mansiones Aldebaran, Alzobra, Alcab y Çaadalechvia, ejercen su poder en Sarrona [?] y Jaén y sus términos hasta llegar a los términos de Córdoba.

Saturno y Júpiter, en las mansiones Alahaca, Açarfa, Axaula y Alfarg el primero, ejercen su poder sobre Talavera y sus términos hasta Medinaceli, abarcando toda Castilla.

Júpiter y Venus, en las mansiones Attaya, Alave, Annaym y Alfarg el posterior, ejercen su poder sobre Sevilla, Carmona, Faz albolot o sea Campo de encinas [actualmente Campo de Calatrava], Toledo y sus términos.

Marte y Saturno, en las mansiones Addira, Açymech, Elbelda y Bathnealhot, ejercen su poder sobre Córdoba y sus términos.

[He hecho el estudio de estas mansiones en los « Libros del saber de Astronomía de ALFONSO EL SABIO », edición RICO y SINOBAS, Madrid, 1863-67, he consultado la obra de NALLINO titulada « Albattani, opus astronomicum, Mediolani, 1903-07, he compulsado el trabajo de *Tallgren* « Los nombres árabes de las estrellas, publicado en el Homenaje a don RAMÓN MENÉNDEZ PIDAL, Madrid, 1925, he mirado los catálogos de estrellas que he tenido a mi alcance y, en resumen, he podido identificar todas las mansiones que cita el « Libro de las cruces » con las 28 mansiones lunares alfonsíes. En la lista siguiente puede verse el nombre de cada mansión, las variantes que ofrece este nombre en otros autores, la traducción española, la denominación estelar y la correspondiente mansión ALFONSí.

Açarfa = As-Sarfah = El retorno al frío o al calor = β del León = Mansión 12.

Açoraya = Al turaiya = La abundancia = η de Tauro (Pléyades) = Mansión 3.

Açymech = Açimet alahazel = As-Simak = Simak al azal = La del vociferante = α de Virgo = Mansión 14.

Addira = Al dira = Addirah al mobçota = El brazo tendido = α, β de Géminis = Mansión 7.

Alahaca = Alhaca = Al Heka = La acostada = λ, ϕ', ϕ'' de Orión = Mansión 5.

Alave = Alaue = Alauwa = Cosa retorcida = β, η, γ, δ, ϵ de Virgo = Mansión 13.

Albotaym = Albotain = Vientre pequeño = ϵ, δ, ρ de Aries = Mansión 2.

Alcab = Alcalb alacrab = Calb alacrab = Antares = El corazón de Escorpión = α de Escorpión = Mansión 18.

Aldebaran = Al debaran = Adebaran = Addauaran = El zaguero = Ain al thaur = El ojo del toro = α de Tauro = Mansión 4.

Alfarg primero = Alfargue almocadem = Vaciadero delantero = α, β del Pegaso = Mansión 26.

Alfarg posterior = Alfargue almohar = Vaciadero posterior = α de Andrómeda y γ, δ del Pegaso. Mansión 27.

Algafr = Algaphr = Algarf = La cosa cubierta = ι, κ, λ de Virgo = Mansión 15.

Algebah = Algjebha = Gebhat alaçed = La frente del león = α, γ, η, ζ de León = Mansión 10.

Alichil = Aliclil = Alyclyl = La corona = θ, κ de Libra y γ de Escorpión = Mansión 17.

Alzobra = Alzubra = Açobra = El yunque con el martillo = δ, θ de León = Mansión 11.

Annacra = Annaçra = Al nethra = La desatada = ϵ de Cáncer = Mansión 8.

Annath = Al nach = El empujamiento = α, η, θ', ι de Aries = Mansión 1.

Annaym = Annaaym = Alnaain = Alnaam = Naam = Los avestruces = σ, ϕ, ζ de Sagitario = Mansión 20.

Attarf = Atarf = Al terfha = Los ojos del león = κ de Escorpión y κ de León = Mansión 9.

Attaya = Athaya = El saludo = γ, ξ de Géminis = Mansión 6.

Axaula = Alshaula = Alxeula = Xeulet alacrab = Las arredradas = λ, υ de Escorpión = Mansión 19.

Azebene = Alzubana = Zubane = Alzuban = Zubaniya = Zebenayn = Los colgaderos de la balanza = Zebenayn alacrab = Los cuernos del escorpión = α, β de Libra = Mansión 16.

Bathnealhot = Bant alhot = Betn alhut = El vientre del pez = β de Andrómeda = Mansión 28.

Çaadaddebe = Çad aldebe = Çad aldebeh = Sad al dabih = La ventura del degollador = α', α'', β, ν de Capricornio = Mansión 22.

Çaadalechvia = Çad alahbia = Sad al achbia = Saad elachbich = La ventura de las tiendas = γ, π, ζ, η de Acuario = Mansión 25.

Caaddebolah = Çad bula = Sad al bula = Saad albelaa = Las venturas de los que comen = μ, ν, ϵ de Acuario = Mansión 23.

Çaadçood = Çad el çohor = Sad al suud = Saad alsaaud = La más venturosa = β, ξ de Acuario = Mansión 24.

Elbelda = Albelda = Elbeldeb = La ciudad = Zona vacía al sudeste de ξ, π, ρ de Sagitario = Mansión 21.

Es importante hacer notar que el orden en que se van citando estas mansiones, en el «Libro de las cruces», es un orden sistemático que consiste, dentro de cada grupo de cuatro, en añadir siete unidades a la mansión anterior, en esta forma : 1-8-15-22; 2-9-16-23; 3-10-17-24; 4-11-18-25; 5-12-19-26; 6-13-20-27; 7-14-21-28. Esta coincidencia resulta, en cierto modo, una confirmación de la identificación.]

Continúa el capítulo expresando que el signo del Zodiaco que ejerce su influjo sobre España y su reinado es Géminis.

Termina explicando el poderío de los planetas con respecto a diversas nacionalidades y establece la correspondencia de Júpiter con los cristianos españoles, Marte con los árabes, Saturno con los de Berbería, Venus con los franceses, Sol con los romanos y alemanes. Aconseja que se tenga en cuenta esta distribución antes de acometer lides, y señala que es conveniente la conjunción de la Luna con el planeta correspondiente.

CAPÍTULO LX. Amplía los juicios que antes expuso en el capítulo LVII y concreta el mayor poder en Saturno y Júpiter. En este capítulo solamente considera los casos en que ambos planetas están en la misma triplicidad, es decir, en signos de igual denominación.

Si están en signos igneos significa gran sequía, malas cosechas y carestía general.

Si están en signos terreos indica buen año de aguas, cosecha abundante y baratura en los víveres.

Si están en signos aereos presagia muchos vientos, grandes lluvias, hielos y pedriscos, daños en las cosechas de granos y horta-

lizas y carestía de víveres y de lanas, cueros y plumas. En los montes y lugares de altura serán mejores las cosechas.

Si están en signos acueos pronostica lluvias aprovechables, abundantes cosechas en las vegas y riberas, precio moderado en el pan y año de excursiones y viajes por mar. En los montes y lugares de altura serán peores las cosechas.

CAPÍTULO LXI. Es continuación del anterior y presenta los casos en que Saturno y Júpiter se encuentren en signos de distinta triplicidad, lo cual da lugar a seis combinaciones.

1ª Acueo con igneo. Significa enfermedades y muertes en los animales domésticos; abundancia y baratura en los lugares septentrionales; escasez y carestía en los lugares meridionales.

2ª Igneo con terreo. Anuncia años de alternativas buenas y malas, pero siempre mejores en las vegas que en los secanos.

3ª Igneo con aereo. Predice un año de sequía y carestía general; habrá tormentas, rayos, epidemias en los hombres y mortandad; por excepción habrá buena cosecha en los nogales, encinas y olivos.

4ª Aereo con terreo. También indica años de alternativas de abundancia y escasez con tendencia a mayor carestía en los lugares orientales y meridionales.

5ª Aereo con acueo. Pronostica un año de buena cosecha, más abundante en los lugares occidentales y meridionales; habrá muchos vientos y muchas lluvias.

6ª Terreo con acueo. Presagia cosechas muy abundantes, baratura en las subsistencias y aumentarán los « fornicios ».

CAPÍTULO LXII. Prosigue la materia de los dos capítulos anteriores, pero precisando en qué signo está cada planeta. Por esta razón resultan doce combinaciones.

1ª Saturno en igneo y Júpiter en aereo. Se corresponde con la 3ª del capítulo anterior, sin modificar la predicción.

2ª Saturno en aereo y Júpiter en igneo. Se corresponde con la misma 3ª del capítulo anterior, pero advierte que la forma es más benigna, en algunos lugares no será mala la cosecha ni habrá carestía y que si Júpiter saliera en aquel año del signo igneo, sería abundante la cosecha.

3ª Saturno en igneo y Júpiter en terreo. Se corresponde con la 2ª del capítulo anterior. Añade que los hombres padecerán fiebres, enfermedades de bazo, parálisis y tisis.

4ª Saturno en terreo y Júpiter en igneo. Se corresponde como

la anterior. Mejora el juicio en cuanto a las cosechas, serán menos las enfermedades, pero será mayor el frío y la sequía.

5ª Saturno en igneo y Júpiter en acueo. Se corresponde con la 1ª del capítulo anterior, pero significa un juicio más favorable.

6ª Saturno en acueo y Júpiter en igneo. Se corresponde como la anterior y añade que en las vegas y llanadas será mayor la abundancia que en los montes.

7ª Saturno en aereo y Júpiter en terreo. Se corresponde con la 4ª del capítulo anterior, pero siendo mejores cosechas en las vegas que en los montes.

8ª Saturno en terreo y Júpiter en aereo. Se diferencia únicamente de la anterior en que serán mejores cosechas en los montes que en las vegas.

9ª Saturno en acueo y Júpiter en aereo. Se corresponde con la 5ª del capítulo anterior y anuncia mejores cosechas en los montes que en las vegas.

10ª Saturno en aereo y Júpiter en acueo. Se corresponde como la anterior, pero pronostica algún daño en las mieses y mejor cosecha en las vegas que en los montes.

11ª Saturno en terreo y Júpiter en acueo. Se corresponde con la 6ª del capítulo anterior con igual presagio.

12ª Saturno en acueo y Júpiter en terreo. Se diferencia únicamente de la anterior en que anuncia más lluvias.

CAPÍTULO LXIII. Recoge en este capítulo las significaciones de la concurrencia de Saturno con la Cabeza de dragón, con arreglo a la calidad del signo en que se encuentren.

1º En signos igneos. Anuncia, en aquel año en que esto ocurra, lides y matanzas entre los hombres, carestía y hambre en las regiones orientales.

2º En signos aereos. Presagia disputas y pleitos entre los hombres, carestía de víveres, muchos vientos y terremotos.

3º En los signos terreos. Indica mortandad en los hombres y los ganados, daños en los cereales y hortalizas, escasez de miel y plagas dañinas de alacranes y otros animales pequeños que se crían en la tierra.

4º En los signos acueos. Predice una abundancia de aguas y lluvias con grandes cosechas y baratura de subsistencias.

CAPÍTULO LXIV. Recuerda lo que son las posiciones en cuadratura y trino para definir los planetas *alzados*. Se dice que

Saturno, por ejemplo, está alzado sobre Júpiter cuando al estar Saturno en la casa 1, Júpiter se encuentra en la 4 (cuadratura) o en la 5 (trino). En cambio, se dice que Júpiter está alzado sobre Saturno cuando al estar Saturno en la casa 1, Júpiter se encuentra en la 10 (cuadratura) o en la 9 (trino). Como lo que se dice respecto de la casa 1 puede aplicarse a otra cualquiera resultan doce posiciones para cada caso.

Si Saturno está alzado sobre Júpiter significa gran sequía, pérdida de cosechas, carestía y hambre en general y emigración de los hombres a otros lugares.

Si Júpiter está alzado sobre Saturno anuncia grandes lluvias, cosechas regulares y una carestía no exagerada.

Este capítulo contiene además la significación de los eclipses que ocurran en el mismo año en que se presenten los anteriores planetas alzados.

Si el eclipse se verifica después del verano, en signo acueo o terreo, predice un invierno muy crudo y si el eclipse tiene lugar antes del verano, éste será muy extremado, habrá gran sequía, ocasionará perjuicios en las cosechas y morirán muchos animales.

CAPÍTULO LXV. La quemazón de Saturno, Júpiter, Marte y Sol, definida en el capítulo IV, significa en general, grandes sequías y un clima muy extremado. Si la quemazón acaece en invierno habra grandes fríos, nieves y heladas entre el 10 de diciembre y el 20 de enero. Si la quemazón ocurre en verano, serán extraordinarios el calor y la sequía entre el 10 de julio y el 20 de agosto.

Los augurios más graves corresponden a los signos igneos y aereos. Señala guerras, peste y destrucción, especialmente en los lugares que estén bajo el influjo de los signos en que se hallen los planetas.

Los signos de las triplicidades terrea y acuea no anuncian daños tan graves.

El hecho de existir dos planetas en un signo y los otros dos en otro signo, atenúa más las desgracias. Habrá grandes lluvias que no perjudicarán.

La existencia de tres planetas situados en signos diversos y la Cabeza de dragón con alguno de aquéllos ya no indica mal presagio.

A continuación presenta casos particulares que tienen significación especial; son los siguientes :

I. Venus con la Cabeza de dragón en cuadratura de las quemantes. El daño es escaso.

II. La quemazón en Géminis y Marte en conjunción o en cuadratura con Saturno o con Sol. Grandes perjuicios.

III. La conjunción de Venus, Cabeza de dragón y tres planetas superiores anuncia siempre abundancia de lluvias, pero será perjudicial si el cuarto planeta se encuentra en cuadratura con los otros tres.

IV. Tres planetas superiores en un signo y la conjunción de Venus, Cabeza de dragón y el cuarto planeta en cuadratura. Aguas y lluvias beneficiosas.

V. Los planetas repartidos y Venus no forma cuadratura con ninguno. Pérdida de cosechas, plagas y guerras en los pueblos sometidos al influjo de los signos en que haya planetas.

VI. Las conjunciones de Sol y Cola de dragón o Júpiter y Cabeza de dragón son de buen presagio.

VII. Marte separado de los otros planetas. Escasez de agua.

VIII. Marte con otro planeta en conjunción y los otros dos planetas separados. Grandes lluvias, abundancia de aguas.

IX. Júpiter y Saturno en signo aereo, Marte con Cabeza de dragón en signo terreo y Sol en signo acueo. Fuertes temporales de lluvia.

X. Saturno en Escorpión, Sol en Léon, Júpiter en Aries y Cabeza de dragón en Géminis. Lluvias y aguaceros perjudiciales en los montes, buena cosecha de aceite, nueces y bellotas, baratura de pan no duradera y una victoria del rey sobre sus enemigos.

En cuanto a la influencia sobre las clases sociales, establece que los signos igneos o aereos y las casas impares encaminan las desgracias a los reyes, dignidades y hombres de elevada categoría, mientras que los signos terreos y acueos y las casas pares marcan las desgracias en las gentes de condición humilde y en los encumbrados injustamente.

Trata finalmente de las constelaciones « en haz » ya sean cerradas o abiertas. Llama constelación cerrada a la formada por cuatro planetas en cuatro signos consecutivos; esta constelación pronostica lluvias beneficiosas, buenas cosechas y baratura en los víveres. Llama constelación abierta a la formada por cuatro planetas y queda un signo vacío entre cada dos, o dos signos vacíos entre cada dos planetas; esta constelación no predice lluvias, pero cuando

la Luna se coloca en uno de los signos vacíos, *cierra* la constelación, y entonces indica lluvia.

En las constelaciones cerradas, la lluvia empieza al entrar la Luna en el 1er signo y continúa hasta que la Luna llega a la cuadratura del 4º. signo. En las constelaciones abiertas, la lluvia cesa al salir la Luna del signo vacío y vuelve a empezar cuando entra en la cuadratura.

Este capítulo, final del libro, termina con la frase : « Dios sea loado y agradecido, que vive y reina in secula seculorum. Amen ».

EXPLICIT. Copiado a la letra dice así :

« Este libro de las cruzes que es muy precioso en los iudizios de las estrellas traslado por mandamento del muy noble Rey don ALFONSO, JHUDA su alfaquim, e su mercet, fy de mosse alchoen, e fue su companero en esta translacion maestre JOHAN DASPA clerigo deste mismo sennor e fue acabado en XXVI dias de febrero en el VII anno que este sennor regno, en era de Cesar mil e dozientos e LXXXXVII y la de los alaraves seyscentos e LVII en el segondo dia de rabe primero ».

Instituto Escuela, Madrid, 1929. JOSÉ A. SÁNCHEZ PÉREZ.

Discovery of the Theory of Natural Selection

With facsimile reproductions (nos. VIII-IX) of DARWIN's *and* WALLACE's *earliest publications on the subject*((1859).

Preface.

It is hardly necessary to explain the import of the texts of which facsimile reproductions are printed below, because this is done with the utmost clarity, brevity, and authority in the prefatory letter (also reproduced) signed by CHARLES LYELL and JOS. D. HOOKER.

The fact that the theory of natural selection should have been discovered independently by two scientists, and that circumstances should have led to a simultaneous publication of their views in the same journal is exceedingly remarkable. To be sure both had been exposed to similar influences, but the main literary source in both cases was the « Essay on the principle of population as it affects the future improvement of society », by THOMAS ROBERT MALTHUS (1798), which was then an old book. As DARWIN wrote it to LYELL (Down, June 18, 1858) : « Your words have come true with a vengeance — that I should be forestalled. You said this, when I explained to you here very briefly my views of ‚Natural Selection' depending on the struggle for existence. I never saw a more striking coincidence; if WALLACE had my MS. sketch written out in 1842, he could not have made a better short abstract ! Even his terms now stand as heads of my chapters. » This quotation is taken from « The life and letters of CHARLES DARWIN » (vol. 2, 116, 1887) where many other documents relative to the writing of the « Origin of the Species » may be found.

In great contrast with the nasty discussions relative to priority

in the discovery of the law of conservation of energy (see *Isis*, 13, 22-25); there was never any quarrel, nor any unpleasant argument, between DARWIN and WALLACE, and their generosity must have exerted a good influence upon their followers, for the conduct of these was equally irreproachable in that respect. The explanation is that DARWIN and WALLACE were not simply great discoverers; they were great men. A keen intelligence is not necessarily associated with a great heart, and unfortunately genius and pusillanimity are not incompatible. DARWIN and WALLACE were noble men. Up to the end each of them always spoke for the other as much as for himself.

It is not necessary to give an account of their lives, as this can easily be read in a number of encyclopædias. Suffice it to recall that WALLACE was fourteen years younger than DARWIN and survived him thirty one years, so that he seemed to belong to a later generation. CHARLES DARWIN (1809-1882) was an Englishman, and ALFRED RUSSEL WALLACE (1823-1913), a Welshman. DARWIN was born on the same day and in the same year as LINCOLN, February 12, 1809.

Though it is an undisputed fact that they were co-discoverers of the theory of natural selection, DARWIN's share in the elaboration of it was considerably greater. DARWIN was a deeper and more systematic thinker. It is pleasant to quote the final words of his autobiography (*op. cit.*, vol. 1, 107) « My success as a man of science, whatever this may have amounted to, has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been — the love of science — unbounded patience in long reflecting over any subject — industry in observing and collecting facts — and a fair share of invention as well as of common sense. With such moderate abilities as I possess, it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points. » This is modesty, but also truthfulness. DARWIN said exactly what he considered the truth.

The simultaneity of DARWIN's and WALLACE's discoveries made us refer a moment ago to the other remarkable simultaneity which had happened sixteen years before. There is another curious point of comparison between these two cases. MAYER made his discovery almost suddenly while he was in Java; WAL-

LACE's conception of his theory was equally sudden; it occurred during an attack of intermittent fever at Ternate, in the Moluccas. Thus two of the greatest theories of modern science were discovered in the East Indies, the perception of the new truth being in each case like a flash of light. In each case the Asiatic discovery was duplicated by a similar one made in Europe far more thoroughly.

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25-57, 1925). Comparison of their contributions to the theory of natural selection.

The facsimiles which follow are extracted from the *Journal of the Linnaean Society*, vol. 3 (Zoology), London, 1859, p. 45-62 :

No. VIII. DARWIN : Extract from a MS. sketched in 1839, copied in 1844. Letter to ASA GRAY, 1857.

No. IX. WALLACE : On the tendency of varieties to depart indefinitely from the original type (written at Ternate, in February, 1858).

The necessary photostats were obtained through the courtesy of the Library of Congress and of Mr. F. E. BRASCH, Secretary of the History of Science Society.

October 31, 1929. GEORGE SARTON.

On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. By Charles Darwin, Esq., F.R.S., F.L.S., & F.G.S., and Alfred Wallace, Esq. Communicated by Sir Charles Lyell, F.R.S., F.L.S., and J. D. Hooker, Esq., M.D., V.P.R.S., F.L.S., &c.

[Read July 1st, 1858.]

London, June 30th, 1858.

My Dear Sir,—The accompanying papers, which we have the honour of communicating to the Linnean Society, and which all relate to the same subject, viz. the Laws which affect the Production of Varieties, Races, and Species, contain the results of the investigations of two indefatigable naturalists, Mr. Charles Darwin and Mr. Alfred Wallace.

These gentlemen having, independently and unknown to one another, conceived the same very ingenious theory to account for the appearance and perpetuation of varieties and of specific forms on our planet, may both fairly claim the merit of being original thinkers in this important line of inquiry; but neither of them having published his views, though Mr. Darwin has for many years past been repeatedly urged by us to do so, and both authors having now unreservedly placed their papers in our hands, we think it would best promote the interests of science that a selection from them should be laid before the Linnean Society.

Taken in the order of their dates, they consist of:—

1. Extracts from a MS. work on Species*, by Mr. Darwin, which was sketched in 1839, and copied in 1844, when the copy was read by Dr. Hooker, and its contents afterwards communicated to Sir Charles Lyell. The first Part is devoted to "The Variation of Organic Beings under Domestication and in their Natural State;" and the second chapter of that Part, from which we propose to read to the Society the extracts referred to, is headed, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."

2. An abstract of a private letter addressed to Professor Asa Gray, of Boston, U.S., in October 1857, by Mr. Darwin, in which

* This MS. work was never intended for publication, and therefore was not written with care.—C. D. 1858.

he repeats his views, and which shows that these remained unaltered from 1839 to 1857.

3. An Essay by Mr. Wallace, entitled "On the Tendency of Varieties to depart indefinitely from the Original Type." This was written at Ternate in February 1858, for the perusal of his friend and correspondent Mr. Darwin, and sent to him with the expressed wish that it should be forwarded to Sir Charles Lyell, if Mr. Darwin thought it sufficiently novel and interesting. So highly did Mr. Darwin appreciate the value of the views therein set forth, that he proposed, in a letter to Sir Charles Lyell, to obtain Mr. Wallace's consent to allow the Essay to be published as soon as possible. Of this step we highly approved, provided Mr. Darwin did not withhold from the public, as he was strongly inclined to do (in favour of Mr. Wallace), the memoir which he had himself written on the same subject, and which, as before stated, one of us had perused in 1844, and the contents of which we had both of us been privy to for many years. On representing this to Mr. Darwin, he gave us permission to make what use we thought proper of his memoir, &c.; and in adopting our present course, of presenting it to the Linnean Society, we have explained to him that we are not solely considering the relative claims to priority of himself and his friend, but the interests of science generally; for we feel it to be desirable that views founded on a wide deduction from facts, and matured by years of reflection, should constitute at once a goal from which others may start, and that, while the scientific world is waiting for the appearance of Mr. Darwin's complete work, some of the leading results of his labours, as well as those of his able correspondent, should together be laid before the public.

We have the honour to be yours very obediently,

CHARLES LYELL.
JOS. D. HOOKER.

J. J. Bennett, Esq.,
Secretary of the Linnean Society.

1. ***Extract from an unpublished Work on Species, by*** C. DARWIN, Esq., ***consisting of a portion of a Chapter entitled, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."***

De Candolle, in an eloquent passage, has declared that all nature is at war, one organism with another, or with external nature.

Seeing the contented face of nature, this may at first well be doubted; but reflection will inevitably prove it to be true. The war, however, is not constant, but recurrent in a slight degree at short periods, and more severely at occasional more distant periods; and hence its effects are easily overlooked. It is the doctrine of Malthus applied in most cases with tenfold force. As in every climate there are seasons, for each of its inhabitants, of greater and less abundance, so all annually breed; and the moral restraint which in some small degree checks the increase of mankind is entirely lost. Even slow-breeding mankind has doubled in twenty-five years; and if he could increase his food with greater ease, he would double in less time. But for animals without artificial means, the amount of food for each species must, *on an average*, be constant, whereas the increase of all organisms tends to be geometrical, and in a vast majority of cases at an enormous ratio. Suppose in a certain spot there are eight pairs of birds, and that *only* four pairs of them annually (including double hatches) rear only four young, and that these go on rearing their young at the same rate, then at the end of seven years (a short life, excluding violent deaths, for any bird) there will be 2048 birds, instead of the original sixteen. As this increase is quite impossible, we must conclude either that birds do not rear nearly half their young, or that the average life of a bird is, from accident, not nearly seven years. Both checks probably concur. The same kind of calculation applied to all plants and animals affords results more or less striking, but in very few instances more striking than in man.

Many practical illustrations of this rapid tendency to increase are on record, among which, during peculiar seasons, are the extraordinary numbers of certain animals; for instance, during the years 1826 to 1828, in La Plata, when from drought some millions of cattle perished, the whole country actually *swarmed* with mice. Now I think it cannot be doubted that during the breeding-season all the mice (with the exception of a few males or females in excess) ordinarily pair, and therefore that this astounding increase during three years must be attributed to a greater number than usual surviving the first year, and then breeding, and so on till the third year, when their numbers were brought down to their usual limits on the return of wet weather. Where man has introduced plants and animals into a new and favourable country, there are many accounts in how surprisingly few years the whole country has become stocked with them. This increase would

necessarily stop as soon as the country was fully stocked; and yet we have every reason to believe, from what is known of wild animals, that *all* would pair in the spring. In the majority of cases it is most difficult to imagine where the checks fall—though generally, no doubt, on the seeds, eggs, and young; but when we remember how impossible, even in mankind (so much better known than any other animal), it is to infer from repeated casual observations what the average duration of life is, or to discover the different percentage of deaths to births in different countries, we ought to feel no surprise at our being unable to discover where the check falls in any animal or plant. It should always be remembered, that in most cases the checks are recurrent yearly in a small, regular degree, and in an extreme degree during unusually cold, hot, dry, or wet years, according to the constitution of the being in question. Lighten any check in the least degree, and the geometrical powers of increase in every organism will almost instantly increase the average number of the favoured species. Nature may be compared to a surface on which rest ten thousand sharp wedges touching each other and driven inwards by incessant blows. Fully to realize these views much reflection is requisite. Malthus on man should be studied; and all such cases as those of the mice in La Plata, of the cattle and horses when first turned out in South America, of the birds by our calculation, &c., should be well considered. Reflect on the enormous multiplying power *inherent and annually in action* in all animals; reflect on the countless seeds scattered by a hundred ingenious contrivances, year after year, over the whole face of the land; and yet we have every reason to suppose that the average percentage of each of the inhabitants of a country usually remains constant. Finally, let it be borne in mind that this average number of individuals (the external conditions remaining the same) in each country is kept up by recurrent struggles against other species or against external nature (as on the borders of the Arctic regions, where the cold checks life), and that ordinarily each individual of every species holds its place, either by its own struggle and capacity of acquiring nourishment in some period of its life, from the egg upwards; or by the struggle of its parents (in short-lived organisms, when the main check occurs at longer intervals) with other individuals of the *same* or *different* species.

But let the external conditions of a country alter. If in a small degree, the relative proportions of the inhabitants will in most cases simply be slightly changed; but let the number of

inhabitants be small, as on an island, and free access to it from other countries be circumscribed, and let the change of conditions continue progressing (forming new stations), in such a case the original inhabitants must cease to be as perfectly adapted to the changed conditions as they were originally. It has been shown in a former part of this work, that such changes of external conditions would, from their acting on the reproductive system, probably cause the organization of those beings which were most affected to become, as under domestication, plastic. Now, can it be doubted, from the struggle each individual has to obtain subsistence, that any minute variation in structure, habits, or instincts, adapting that individual better to the new conditions, would tell upon its vigour and health? In the struggle it would have a better *chance* of surviving; and those of its offspring which inherited the variation, be it ever so slight, would also have a better *chance*. Yearly more are bred than can survive; the smallest grain in the balance, in the long run, must tell on which death shall fall, and which shall survive. Let this work of selection on the one hand, and death on the other, go on for a thousand generations, who will pretend to affirm that it would produce no effect, when we remember what, in a few years, Bakewell effected in cattle, and Western in sheep, by this identical principle of selection?

To give an imaginary example from changes in progress on an island:—let the organization of a canine animal which preyed chiefly on rabbits, but sometimes on hares, become slightly plastic; let these same changes cause the number of rabbits very slowly to decrease, and the number of hares to increase; the effect of this would be that the fox or dog would be driven to try to catch more hares: his organization, however, being slightly plastic, those individuals with the lightest forms, longest limbs, and best eyesight, let the difference be ever so small, would be slightly favoured, and would tend to live longer, and to survive during that time of the year when food was scarcest; they would also rear more young, which would tend to inherit these slight peculiarities. The less fleet ones would be rigidly destroyed. I can see no more reason to doubt that these causes in a thousand generations would produce a marked effect, and adapt the form of the fox or dog to the catching of hares instead of rabbits, than that greyhounds can be improved by selection and careful breeding. So would it be with plants under similar circumstances. If the number of individuals of a species with plumed seeds could be increased by greater powers of dissemination within its own area

(that is, if the check to increase fell chiefly on the seeds), those seeds which were provided with ever so little more down, would in the long run be most disseminated; hence a greater number of seeds thus formed would germinate, and would tend to produce plants inheriting the slightly better-adapted down*.

Besides this natural means of selection, by which those individuals are preserved, whether in their egg, or larval, or mature state, which are best adapted to the place they fill in nature, there is a second agency at work in most unisexual animals, tending to produce the same effect, namely, the struggle of the males for the females. These struggles are generally decided by the law of battle, but in the case of birds, apparently, by the charms of their song, by their beauty or their power of courtship, as in the dancing rock-thrush of Guiana. The most vigorous and healthy males, implying perfect adaptation, must generally gain the victory in their contests. This kind of selection, however, is less rigorous than the other; it does not require the death of the less successful, but gives to them fewer descendants. The struggle falls, moreover, at a time of year when food is generally abundant, and perhaps the effect chiefly produced would be the modification of the secondary sexual characters, which are not related to the power of obtaining food, or to defence from enemies, but to fighting with or rivalling other males. The result of this struggle amongst the males may be compared in some respects to that produced by those agriculturists who pay less attention to the careful selection of all their young animals, and more to the occasional use of a choice mate

II. *Abstract of a Letter from* C. DARWIN, Esq., *to* Prof. ASA GRAY, *Boston, U.S., dated Down, September 5th*, 1857.

1. It is wonderful what the principle of selection by man, that is the picking out of individuals with any desired quality, and breeding from them, and again picking out, can do. Even breeders have been astounded at their own results. They can act on differences inappreciable to an uneducated eye. Selection has been *methodically* followed in *Europe* for only the last half century; but it was occasionally, and even in some degree methodically, followed in the most ancient times. There must have been also a kind of unconscious selection from a remote period, namely in

* I can see no more difficulty in this, than in the planter improving his varieties of the cotton plant.—C. D. 1858.

the preservation of the individual animals (without any thought of their offspring) most useful to each race of man in his particular circumstances. The "roguing," as nurserymen call the destroying of varieties which depart from their type, is a kind of selection. I am convinced that intentional and occasional selection has been the main agent in the production of our domestic races; but however this may be, its great power of modification has been indisputably shown in later times. Selection acts only by the accumulation of slight or greater variations, caused by external conditions, or by the mere fact that in generation the child is not absolutely similar to its parent. Man, by this power of accumulating variations, adapts living beings to his wants—may be said to make the wool of one sheep good for carpets, of another for cloth, &c.

2. Now suppose there were a being who did not judge by mere external appearances, but who could study the whole internal organization, who was never capricious, and should go on selecting for one object during millions of generations; who will say what he might not effect? In nature we have some *slight* variation occasionally in all parts; and I think it can be shown that changed conditions of existence is the main cause of the child not exactly resembling its parents; and in nature geology shows us what changes have taken place, and are taking place. We have almost unlimited time; no one but a practical geologist can fully appreciate this. Think of the Glacial period, during the whole of which the same species at least of shells have existed; there must have been during this period millions on millions of generations.

3. I think it can be shown that there is such an unerring power at work in *Natural Selection* (the title of my book), which selects exclusively for the good of each organic being. The elder De Candolle, W. Herbert, and Lyell have written excellently on the struggle for life; but even they have not written strongly enough. Reflect that every being (even the elephant) breeds at such a rate, that in a few years, or at most a few centuries, the surface of the earth would not hold the progeny of one pair. I have found it hard constantly to bear in mind that the increase of every single species is checked during some part of its life, or during some shortly recurrent generation. Only a few of those annually born can live to propagate their kind. What a trifling difference must often determine which shall survive, and which perish!

4. Now take the case of a country undergoing some change. This will tend to cause some of its inhabitants to vary slightly—

not but that I believe most beings vary at all times enough for selection to act on them. Some of its inhabitants will be exterminated; and the remainder will be exposed to the mutual action of a different set of inhabitants, which I believe to be far more important to the life of each being than mere climate. Considering the infinitely various methods which living beings follow to obtain food by struggling with other organisms, to escape danger at various times of life, to have their eggs or seeds disseminated, &c. &c., I cannot doubt that during millions of generations individuals of a species will be occasionally born with some slight variation, profitable to some part of their economy. Such individuals will have a better chance of surviving, and of propagating their new and slightly different structure; and the modification may be slowly increased by the accumulative action of natural selection to any profitable extent. The variety thus formed will either coexist with, or, more commonly, will exterminate its parent form. An organic being, like the woodpecker or misseltoe, may thus come to be adapted to a score of contingences—natural selection accumulating those slight variations in all parts of its structure, which are in any way useful to it during any part of its life.

5. Multiform difficulties will occur to every one, with respect to this theory. Many can, I think, be satisfactorily answered. *Natura non facit saltum* answers some of the most obvious. The slowness of the change, and only a very few individuals undergoing change at any one time, answers others. The extreme imperfection of our geological records answers others.

6. Another principle, which may be called the principle of divergence, plays, I believe, an important part in the origin of species. The same spot will support more life if occupied by very diverse forms. We see this in the many generic forms in a square yard of turf, and in the plants or insects on any little uniform islet, belonging almost invariably to as many genera and families as species. We can understand the meaning of this fact amongst the higher animals, whose habits we understand. We know that it has been experimentally shown that a plot of land will yield a greater weight if sown with several species and genera of grasses, than if sown with only two or three species. Now, every organic being, by propagating so rapidly, may be said to be striving its utmost to increase in numbers. So it will be with the offspring of any species after it has become diversified into varieties, or subspecies, or true species. And it follows, I think, from the foregoing facts, that the varying offspring of each species will try

(only few will succeed) to seize on as many and as diverse places in the economy of nature as possible. Each new variety or species, when formed, will generally take the place of, and thus exterminate its less well-fitted parent. This I believe to be the origin of the classification and affinities of organic beings at all times; for organic beings always *seem* to branch and sub-branch like the limbs of a tree from a common trunk, the flourishing and diverging twigs destroying the less vigorous—the dead and lost branches rudely representing extinct genera and families.

This sketch is *most* imperfect; but in so short a space I cannot make it better. Your imagination must fill up very wide blanks.

C. DARWIN.

III. *On the Tendency of Varieties to depart indefinitely from the Original Type.* By ALFRED RUSSEL WALLACE.

One of the strongest arguments which have been adduced to prove the original and permanent distinctness of species is, that *varieties* produced in a state of domesticity are more or less unstable, and often have a tendency, if left to themselves, to return to the normal form of the parent species; and this instability is considered to be a distinctive peculiarity of all varieties, even of those occurring among wild animals in a state of nature, and to constitute a provision for preserving unchanged the originally created distinct species.

In the absence or scarcity of facts and observations as to *varieties* occurring among wild animals, this argument has had great weight with naturalists, and has led to a very general and somewhat prejudiced belief in the stability of species. Equally general, however, is the belief in what are called "permanent or true varieties,"—races of animals which continually propagate their like, but which differ so slightly (although constantly) from some other race, that the one is considered to be a *variety* of the other. Which is the *variety* and which the original *species*, there is generally no means of determining, except in those rare cases in which the one race has been known to produce an offspring unlike itself and resembling the other. This, however, would seem quite incompatible with the "permanent invariability of species," but the difficulty is overcome by assuming that such varieties have strict limits, and can never again vary further from the original type, although they may return to it, which, from the

analogy of the domesticated animals, is considered to be highly probable, if not certainly proved.

It will be observed that this argument rests entirely on the assumption, that *varieties* occurring in a state of nature are in all respects analogous to or even identical with those of domestic animals, and are governed by the same laws as regards their permanence or further variation. But it is the object of the present paper to show that this assumption is altogether false, that there is a general principle in nature which will cause many *varieties* to survive the parent species, and to give rise to successive variations departing further and further from the original type, and which also produces, in domesticated animals, the tendency of varieties to return to the parent form.

The life of wild animals is a struggle for existence. The full exertion of all their faculties and all their energies is required to preserve their own existence and provide for that of their infant offspring. The possibility of procuring food during the least favourable seasons, and of escaping the attacks of their most dangerous enemies, are the primary conditions which determine the existence both of individuals and of entire species. These conditions will also determine the population of a species; and by a careful consideration of all the circumstances we may be enabled to comprehend, and in some degree to explain, what at first sight appears so inexplicable—the excessive abundance of some species, while others closely allied to them are very rare.

The general proportion that must obtain between certain groups of animals is readily seen. Large animals cannot be so abundant as small ones; the carnivora must be less numerous than the herbivora; eagles and lions can never be so plentiful as pigeons and antelopes; the wild asses of the Tartarian deserts cannot equal in numbers the horses of the more luxuriant prairies and pampas of America. The greater or less fecundity of an animal is often considered to be one of the chief causes of its abundance or scarcity; but a consideration of the facts will show us that it really has little or nothing to do with the matter. Even the least prolific of animals would increase rapidly if unchecked, whereas it is evident that the animal population of the globe must be stationary, or perhaps, through the influence of man, decreasing. Fluctuations there may be; but permanent increase, except in restricted localities, is almost impossible. For example, our own observation must convince us that birds do not go on increasing every year in a geometrical ratio, as they would do, were there not

some powerful check to their natural increase. Very few birds produce less than two young ones each year, while many have six, eight, or ten; four will certainly be below the average; and if we suppose that each pair produce young only four times in their life, that will also be below the average, supposing them not to die either by violence or want of food. Yet at this rate how tremendous would be the increase in a few years from a single pair! A simple calculation will show that in fifteen years each pair of birds would have increased to nearly ten millions! whereas we have no reason to believe that the number of the birds of any country increases at all in fifteen or in one hundred and fifty years. With such powers of increase the population must have reached its limits, and have become stationary, in a very few years after the origin of each species. It is evident, therefore, that each year an immense number of birds must perish—as many in fact as are born; and as on the lowest calculation the progeny are each year twice as numerous as their parents, it follows that, whatever be the average number of individuals existing in any given country, *twice that number must perish annually*,—a striking result, but one which seems at least highly probable, and is perhaps under rather than over the truth. It would therefore appear that, as far as the continuance of the species and the keeping up the average number of individuals are concerned, large broods are superfluous. On the average all above *one* become food for hawks and kites, wild cats and weasels, or perish of cold and hunger as winter comes on. This is strikingly proved by the case of particular species; for we find that their abundance in individuals bears no relation whatever to their fertility in producing offspring. Perhaps the most remarkable instance of an immense bird population is that of the passenger pigeon of the United States, which lays only one, or at most two eggs, and is said to rear generally but one young one. Why is this bird so extraordinarily abundant, while others producing two or three times as many young are much less plentiful? The explanation is not difficult. The food most congenial to this species, and on which it thrives best, is abundantly distributed over a very extensive region, offering such differences of soil and climate, that in one part or another of the area the supply never fails. The bird is capable of a very rapid and long-continued flight, so that it can pass without fatigue over the whole of the district it inhabits, and as soon as the supply of food begins to fail in one place is able to discover a fresh feeding-ground. This example strikingly shows us that the procuring a constant supply

of wholesome food is almost the sole condition requisite for ensuring the rapid increase of a given species, since neither the limited fecundity, nor the unrestrained attacks of birds of prey and of man are here sufficient to check it. In no other birds are these peculiar circumstances so strikingly combined. Either their food is more liable to failure, or they have not sufficient power of wing to search for it over an extensive area, or during some season of the year it becomes very scarce, and less wholesome substitutes have to be found; and thus, though more fertile in offspring, they can never increase beyond the supply of food in the least favourable seasons. Many birds can only exist by migrating, when their food becomes scarce, to regions possessing a milder, or at least a different climate, though, as these migrating birds are seldom excessively abundant, it is evident that the countries they visit are still deficient in a constant and abundant supply of wholesome food. Those whose organization does not permit them to migrate when their food becomes periodically scarce, can never attain a large population. This is probably the reason why woodpeckers are scarce with us, while in the tropics they are among the most abundant of solitary birds. Thus the house sparrow is more abundant than the redbreast, because its food is more constant and plentiful,—seeds of grasses being preserved during the winter, and our farm-yards and stubble-fields furnishing an almost inexhaustible supply. Why, as a general rule, are aquatic, and especially sea birds, very numerous in individuals? Not because they are more prolific than others, generally the contrary; but because their food never fails, the sea-shores and river-banks daily swarming with a fresh supply of small mollusca and crustacea. Exactly the same laws will apply to mammals. Wild cats are prolific and have few enemies; why then are they never as abundant as rabbits? The only intelligible answer is, that their supply of food is more precarious. It appears evident, therefore, that so long as a country remains physically unchanged, the numbers of its animal population cannot materially increase. If one species does so, some others requiring the same kind of food must diminish in proportion. The numbers that die annually must be immense; and as the individual existence of each animal depends upon itself, those that die must be the weakest—the very young, the aged, and the diseased,—while those that prolong their existence can only be the most perfect in health and vigour—those who are best able to obtain food regularly, and avoid their numerous enemies. It is, as we commenced by remarking, "a struggle for existence," in

which the weakest and least perfectly organized must always succumb.

Now it is clear that what takes place among the individuals of a species must also occur among the several allied species of a group,—viz. that those which are best adapted to obtain a regular supply of food, and to defend themselves against the attacks of their enemies and the vicissitudes of the seasons, must necessarily obtain and preserve a superiority in population; while those species which from some defect of power or organization are the least capable of counteracting the vicissitudes of food, supply, &c., must diminish in numbers, and, in extreme cases, become altogether extinct. Between these extremes the species will present various degrees of capacity for ensuring the means of preserving life; and it is thus we account for the abundance or rarity of species. Our ignorance will generally prevent us from accurately tracing the effects to their causes; but could we become perfectly acquainted with the organization and habits of the various species of animals, and could we measure the capacity of each for performing the different acts necessary to its safety and existence under all the varying circumstances by which it is surrounded, we might be able even to calculate the proportionate abundance of individuals which is the necessary result.

If now we have succeeded in establishing these two points—1st, *that the animal population of a country is generally stationary, being kept down by a periodical deficiency of food, and other checks*; and, 2nd, *that the comparative abundance or scarcity of the individuals of the several species is entirely due to their organization and resulting habits, which, rendering it more difficult to procure a regular supply of food and to provide for their personal safety in some cases than in others, can only be balanced by a difference in the population which have to exist in a given area*—we shall be in a condition to proceed to the consideration of *varieties*, to which the preceding remarks have a direct and very important application.

Most or perhaps all the variations from the typical form of a species must have some definite effect, however slight, on the habits or capacities of the individuals. Even a change of colour might, by rendering them more or less distinguishable, affect their safety; a greater or less development of hair might modify their habits. More important changes, such as an increase in the power or dimensions of the limbs or any of the external organs, would more or less affect their mode of procuring food or the range of

country which they inhabit. It is also evident that most changes would affect, either favourably or adversely, the powers of prolonging existence. An antelope with shorter or weaker legs must necessarily suffer more from the attacks of the feline carnivora; the passenger pigeon with less powerful wings would sooner or later be affected in its powers of procuring a regular supply of food; and in both cases the result must necessarily be a diminution of the population of the modified species. If, on the other hand, any species should produce a variety having slightly increased powers of preserving existence, that variety must inevitably in time acquire a superiority in numbers. These results must follow as surely as old age, intemperance, or scarcity of food produce an increased mortality. In both cases there may be many individual exceptions; but on the average the rule will invariably be found to hold good. All varieties will therefore fall into two classes—those which under the same conditions would never reach the population of the parent species, and those which would in time obtain and keep a numerical superiority. Now, let some alteration of physical conditions occur in the district—a long period of drought, a destruction of vegetation by locusts, the irruption of some new carnivorous animal seeking "pastures new"—any change in fact tending to render existence more difficult to the species in question, and tasking its utmost powers to avoid complete extermination; it is evident that, of all the individuals composing the species, those forming the least numerous and most feebly organized variety would suffer first, and, were the pressure severe, must soon become extinct. The same causes continuing in action, the parent species would next suffer, would gradually diminish in numbers, and with a recurrence of similar unfavourable conditions might also become extinct. The superior variety would then alone remain, and on a return to favourable circumstances would rapidly increase in numbers and occupy the place of the extinct species and variety.

The *variety* would now have replaced the *species*, of which it would be a more perfectly developed and more highly organized form. It would be in all respects better adapted to secure its safety, and to prolong its individual existence and that of the race. Such a variety *could not* return to the original form; for that form is an inferior one, and could never compete with it for existence. Granted, therefore, a "tendency" to reproduce the original type of the species, still the variety must ever remain preponderant in numbers, and under adverse physical conditions *again alone survive*.

But this new, improved, and populous race might itself, in course of time, give rise to new varieties, exhibiting several diverging modifications of form, any of which, tending to increase the facilities for preserving existence, must, by the same general law, in their turn become predominant. Here, then, we have *progression and continued divergence* deduced from the general laws which regulate the existence of animals in a state of nature, and from the undisputed fact that varieties do frequently occur. It is not, however, contended that this result would be invariable; a change of physical conditions in the district might at times materially modify it, rendering the race which had been the most capable of supporting existence under the former conditions now the least so, and even causing the extinction of the newer and, for a time, superior race, while the old or parent species and its first inferior varieties continued to flourish. Variations in unimportant parts might also occur, having no perceptible effect on the life-preserving powers; and the varieties so furnished might run a course parallel with the parent species, either giving rise to further variations or returning to the former type. All we argue for is, that certain varieties have a tendency to maintain their existence longer than the original species, and this tendency must make itself felt; for though the doctrine of chances or averages can never be trusted to on a limited scale, yet, if applied to high numbers, the results come nearer to what theory demands, and, as we approach to an infinity of examples, become strictly accurate. Now the scale on which nature works is so vast—the numbers of individuals and periods of time with which she deals approach so near to infinity, that any cause, however slight, and however liable to be veiled and counteracted by accidental circumstances, must in the end produce its full legitimate results.

Let us now turn to domesticated animals, and inquire how varieties produced among them are affected by the principles here enunciated. The essential difference in the condition of wild and domestic animals is this,—that among the former, their well-being and very existence depend upon the full exercise and healthy condition of all their senses and physical powers, whereas, among the latter, these are only partially exercised, and in some cases are absolutely unused. A wild animal has to search, and often to labour, for every mouthful of food—to exercise sight, hearing, and smell in seeking it, and in avoiding dangers, in procuring shelter from the inclemency of the seasons, and in providing for the subsistence and safety of its offspring. There is no muscle of

its body that is not called into daily and hourly activity; there is no sense or faculty that is not strengthened by continual exercise. The domestic animal, on the other hand, has food provided for it, is sheltered, and often confined, to guard it against the vicissitudes of the seasons, is carefully secured from the attacks of its natural enemies, and seldom even rears its young without human assistance. Half of its senses and faculties are quite useless; and the other half are but occasionally called into feeble exercise, while even its muscular system is only irregularly called into action.

Now when a variety of such an animal occurs, having increased power or capacity in any organ or sense, such increase is totally useless, is never called into action, and may even exist without the animal ever becoming aware of it. In the wild animal, on the contrary, all its faculties and powers being brought into full action for the necessities of existence, any increase becomes immediately available, is strengthened by exercise, and must even slightly modify the food, the habits, and the whole economy of the race. It creates as it were a new animal, one of superior powers, and which will necessarily increase in numbers and outlive those inferior to it.

Again, in the domesticated animal all variations have an equal chance of continuance; and those which would decidedly render a wild animal unable to compete with its fellows and continue its existence are no disadvantage whatever in a state of domesticity. Our quickly fattening pigs, short-legged sheep, pouter pigeons, and poodle dogs could never have come into existence in a state of nature, because the very first step towards such inferior forms would have led to the rapid extinction of the race; still less could they now exist in competition with their wild allies. The great speed but slight endurance of the race horse, the unwieldy strength of the ploughman's team, would both be useless in a state of nature. If turned wild on the pampas, such animals would probably soon become extinct, or under favourable circumstances might each lose those extreme qualities which would never be called into action, and in a few generations would revert to a common type, which must be that in which the various powers and faculties are so proportioned to each other as to be best adapted to procure food and secure safety,—that in which by the full exercise of every part of his organization the animal can alone continue to live. Domestic varieties, when turned wild, *must* return to something near the type of the original wild stock, *or become altogether extinct*.

We see, then, that no inferences as to varieties in a state of nature can be deduced from the observation of those occurring among domestic animals. The two are so much opposed to each other in every circumstance of their existence, that what applies to the one is almost sure not to apply to the other. Domestic animals are abnormal, irregular, artificial; they are subject to varieties which never occur and never can occur in a state of nature: their very existence depends altogether on human care; so far are many of them removed from that just proportion of faculties, that true balance of organization, by means of which alone an animal left to its own resources can preserve its existence and continue its race.

The hypothesis of Lamarck—that progressive changes in species have been produced by the attempts of animals to increase the development of their own organs, and thus modify their structure and habits—has been repeatedly and easily refuted by all writers on the subject of varieties and species, and it seems to have been considered that when this was done the whole question has been finally settled; but the view here developed renders such an hypothesis quite unnecessary, by showing that similar results must be produced by the action of principles constantly at work in nature. The powerful retractile talons of the falcon- and the cat-tribes have not been produced or increased by the volition of those animals; but among the different varieties which occurred in the earlier and less highly organized forms of these groups, *those always survived longest which had the greatest facilities for seizing their prey.* Neither did the giraffe acquire its long neck by desiring to reach the foliage of the more lofty shrubs, and constantly stretching its neck for the purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.* Even the peculiar colours of many animals, especially insects, so closely resembling the soil or the leaves or the trunks on which they habitually reside, are explained on the same principle; for though in the course of ages varieties of many tints may have occurred, *yet those races having colours best adapted to concealment from their enemies would inevitably survive the longest.* We have also here an acting cause to account for that balance so often observed in nature,—a deficiency in one set of organs always being compensated by an increased development of some others—powerful wings accompanying weak

feet, or great velocity making up for the absence of defensive weapons; for it has been shown that all varieties in which an unbalanced deficiency occurred could not long continue their existence. The action of this principle is exactly like that of the centrifugal governor of the steam engine, which checks and corrects any irregularities almost before they become evident; and in like manner no unbalanced deficiency in the animal kingdom can ever reach any conspicuous magnitude, because it would make itself felt at the very first step, by rendering existence difficult and extinction almost sure soon to follow. An origin such as is here advocated will also agree with the peculiar character of the modifications of form and structure which obtain in organized beings—the many lines of divergence from a central type, the increasing efficiency and power of a particular organ through a succession of allied species, and the remarkable persistence of uninportant parts such as colour, texture of plumage and hair, form of horns or crests, through a series of species differing considerably in more essential characters. It also furnishes us with a reason for that "more specialized structure" which Professor Owen states to be a characteristic of recent compared with extinct forms, and which would evidently be the result of the progressive modification of any organ applied to a special purpose in the animal economy.

We believe we have now shown that there is a tendency in nature to the continued progression of certain classes of *varieties* further and further from the original type—a progression to which there appears no reason to assign any definite limits—and that the same principle which produces this result in a state of nature will also explain why domestic varieties have a tendency to revert to the original type. This progression, by minute steps, in various directions, but always checked and balanced by the necessary conditions, subject to which alone existence can be preserved, may, it is believed, be followed out so as to agree with all the phenomena presented by organized beings, their extinction and succession in past ages, and all the extraordinary modifications of form, instinct, and habits which they exhibit.

Ternate, February, 1858.

Une opinion inédite de Newton sur " l'Analyse des Anciens " à propos de l'Analysis geometrica de Hugo de Omerique

La plupart des manuscrits de NEWTON qui sont conservés à Oxford semblent avoir déjà été l'objet d'examens minutieux, notamment de la part de BAILY et de BREWSTER. Les plus importants ont été publiés depuis longtemps. Néanmoins si l'édition de la correspondance de l'auteur des *Principes* était enfin entreprise (1) à l'occasion du prochain tricentenaire de sa naissance (1942) — ce qui provoquerait vraisemblablement la découverte de nombreuses lettres dont plusieurs générations d'historiens ont jusqu'à présent déploré la perte — une révision minutieuse des manuscrits d'Oxford s'impose.

En novembre 1928, j'ai eu l'occasion d'en examiner une grande partie. S'il n'y a plus grand chose à dire à propos des lettres à FLAMSTEED, le volumineux ensemble de manuscrits classés à la bibliothèque de New College sous le nº 361 mérite une attention spéciale. Car si cet amas énorme de feuillets entiers, et même de cahiers, consacrés uniquement à des recherches d'exégèse et de chronologie est assez décevant, en revanche les rares fragments scientifiques qui y sont égarés ne méritent pas tous l'oubli. Leur lecture est souvent pénible : certaines feuilles en effet ont été partiellement la proie du feu, et NEWTON avait aussi coutume de combler en tous sens de sa fine écriture les blancs de vieux papier. Une enveloppe adressée

A Monsr
Monsr John Bernoulli Professeur
des Mathematiques a Basle
en la Suisse.

(1) Cf. la lettre de Sir JOSEPH LARMOR (7 mai 1924) dans *Nature*, vol. 113, p. 744.

est couverte de calculs. On trouve des comptes d'argent, des documents relatifs à l'élection de NEWTON au Parlement, des calculs plus ou moins rédigés :

« In 15" or 14 3/4". 7 1/2". 3 3/4" it fell 113 1/4 inches
« In 60" = 1' it fell 453 digits. In 20" it fell
« 151 dig = 12ped. 7 dig.
« In a minute it falls 37 3/4ped : In 4 minutes it
« falls 151 english feet.

Parmi les brouillons de lettres, le suivant — quoique fort court — m'a paru particulièrement intéressant. Le nom du destinataire n'est pas indiqué, non plus que la date, mais, comme on le verra plus loin, cette lettre inachevée a été écrite probablement vers 1699. Je tiens à exprimer ma reconnaissance à Mr. le Bibliothécaire de New College, qui a bien voulu m'autoriser à la publier.

***

Sr

I have lookt into De Omerique's Analysis Geometrica & find it a judicious & valuable piece answering to y^e^ Title. ffor therin is laid a foundation for restoring the Analysis of the Ancients w^ch^ is more simple more ingenious & more fit for a Geometer then the Algebra of the Moderns. ffor it leads him more easily & readily to the composition of Problems & the Composition w^ch^ it leads him to is usually more simple & elegant then that w^ch^ is forct from Algebra.

***

Voici le titre complet de l'ouvrage dont parle NEWTON : *Analysis geometrica sive nova, et vera methodus resolvendi tam problemata geometrica, quam arithmeticas quaestiones. Pars prima de planis*. Authore D. ANTONIO HUGONE DE OMERIQUE, Sanlucarense. Gadibus 1698.

PEDRO A. BERENGUER dans un article de *El Progreso matemático* (2) nous a donné les deux ou trois renseignements que l'on possède sur la vie et les écrits de HUGO DE OMERIQUE. Celui

(2) 1895, pp. 116-121. Mr. le Professeur R. C. ARCHIBALD, de Brown University, Providence, a aimablement consenti à me prêter son exemplaire de l'*Analysis geometrica*, exemplaire peut-être unique aux États-Unis, ainsi que l'année 1895 de *El Progreso matemático*. Qu'il veuille trouver ici l'expression de ma vive gratitude.

qu'on a voulu appeler le Descartes espagnol est né à Sanlucar de Barrameda le 6 janvier 1634 et est mort à une date inconnue. Il fut élève des Jésuites et demeura toute sa vie durant sous leur influence. Outre l'*Analysis geometrica*, il ne nous est parvenu de lui que des *Tablas Artificiales* (Cadix, 1691).

MONTUCLA (3) — et de nombreux auteurs l'ont répété après lui — a prétendu que NEWTON citait avec éloge l'ouvrage du mathématicien espagnol. Mais il n'indique aucune référence à l'appui de son affirmation et j'ai vainement cherché une allusion à HUGO DE OMERIQUE dans les œuvres et la correspondance de l'auteur des *Principes*. La publication du court fragment ci-dessus ne m'en paraissait que plus intéressante, et, comme d'autre part, l'*Analysis geometrica* est un ouvrage d'une grande rareté, je vais essayer de donner rapidement une idée de ce gros in-quarto de 444 pages, bien qu'il ait déjà fait l'objet d'un compte-rendu anonyme (qu'aucun auteur ne mentionne) dans les *Philosophical Transactions* (vol. 21, nº 257, October 1699, pp. 351-362) (4).

Il s'agit en réalité d'un manuel scolaire. L'auteur, étudiant l'application de l'algèbre à la géométrie plane, emploie la méthode analytique : le problème est supposé résolu; on établit les relations entre les données et les inconnues, et on déduit de ces relations la valeur des quantités cherchées.

L'introduction ne comprend pas moins de 96 pages, dont les 4 premières présentent un intérêt particulier, car DE OMERIQUE y définit l'analyse et la synthèse. Voici la première partie de l'introduction proprement dite :

Quid sit Analysis.

Postquam elementis Geometricis instructus fuerit, qui Geometra vocari cupit, fructumque colligere laboris sui : aliquam sibi viam

(3) *Histoire des Mathématiques*, 2e édition, t. 2, p. 167.

(4) La numérotation des pages dans le numéro d'octobre 1699 est correcte jusqu'à la page 366; ensuite, par une erreur d'impression, les pages suivantes sont numérotées une seconde fois de 351 à 362 : ce sont ces dernières qui contiennent le compte-rendu en question. En voici le début :

« The Author of this Book being of opinion that the Method of deducing Geometric Demonstrations from an Algebraic Calculation, is forc'd and unnatural, has studied how to find an Analysis purely Geometrical, from which a Synthesis might easily be deriv'd, according to the Method of the Ancients. »

paratam habere debet, cuius ope vim, & facultatem cuiuscumque Geometricae propositionis resolutionem inveniendi acquirat.

Haec quidem via, quaecumque illa sit, analysis, seu resolutio dicitur, & omnium consensu ita definitur. *Assumptio quaesiti tamquam concessi, per ea, quae deinceps consequuntur ad aliquod concessum procedens.* Regressus vero a concesso ad quaesitum *Synthesis*, seu compositio nominatur. Verum enimvero ista definitio nihil nobis certi promittit. In assumptione quidem quaesiti tamquam concessi aliqua inest interdum difficultas, in eo consistens, quod data, & quaesita adcommodam contiguitatem reduci debeant. Iam vero posito quaesito tamquam concesso, quaenam ex multis quae deinceps consequuntur eligemus? Quorsum tendimus? Haec omnia profecto nobis incerta reliquerunt Authores, unde sit, quod quando abstrusa, & intricata inter data, & quaesita est connexio, haereat analysta, quo se convertat nesciens. Fateantur omnes, neque veterum quisquam perficiari auderet cum postquam tot, tantaque volumina hac de re conscripsissent, ut nobis tradit PAPPUS initio libri septimi; nullam tamen habuisse veram rationem resolvendi, ex ipsorum propositionibus non temere suspicentur juniores. Ex recentioribus autem Algebrae speciosae cultores hanc vim resolvendi sibi adjudicare videntur. Utinam aeque facilis, ac resolutio algebrica, esset geometrica demonstratio; sed tantum abest, ut postquam multos annos in concinnandis demonstracionibus geometricis ex calculo Algebrico consumpsissem, violentam esse methodu in Geometricis putaverim, viamque omnino Geometricam ineundam concluserim.

Analysim igitur nostram nos ita definimus. *Assumptio quaesiti tamquam concessi, per necessarias consequentias ad certum, & determinatum finem progrediens.* Haec equidem definitio nobis securum gressum promittere videtur. Conabimur promissa adimplere; sed quoniam arduam nimis aggredimur materiam, scopum tetigisse nobis suadere non audemus; suspiciendos potius tantorum virorum, qui de resolucione scripsere veneramur labores, atque faelicioribus ingeniis nostros judicandos, promovendosque, si forte conducere visi fuerint, relinquimus.

Le reste de l'introduction (pp. 5-96) est consacré à des problèmes de constructions géométriques et de proportions. DE OMERIQUE a cru bon d'insérer dans cette partie de son livre (pp. 49-66) un

petit traité intitulé *Algorithmus Rationum*, dû au Père C. POWELL, professeur de mathématiques au collège des jésuites à Cadix.

Le livre I (pp. 97-238) traite de la résolution des problèmes par les rapports de proportionalités entre les droites. Le livre II (pp. 239-304) poursuit le même but que le livre I et fait usage de la raison composée et des figures semblables. Dans le livre III (pp. 305-388) on résoud les problèmes par la comparaison de nombres plans. Le livre IV (pp. 389-434) s'occupe des cas de compatibilité des problèmes (problèmes indéterminés).

Il y a, pour plusieurs problèmes, des citations en marge des auteurs qui en ont donné des solutions. C'est ainsi que l'on rencontre les noms de FR. VAN SCHOOTEN, CLAVIUS, VIÈTE, REINHOLD, TACQUET, JOSÉ ZARAGOZA, GRÉGOIRE DE ST.-VINCENT, JOSÉ DE CAÑAS, APOLLONIUS, PAPPUS et DESCARTES.

Une des originalités les plus certaines de l'*Analysis geometrica* est l'emploi — sans doute unique — de la notation $\_\wedge\_$ comme symbole d'égalité et d'équivalence. Mr. CAJORI a fait remarquer que le symbole d'égalité employé par DESCARTES dans sa *Geometrie* — symbole sur l'origine duquel on ne possède aucun document — était, à peu de chose près, identique à la représentation de la constellation zodiacale du Taureau. Toutefois, comme la représentation des signes du zodiaque est extrêmement libre à travers l'histoire, on trouve sans peine des signes du Bélier qui diffèrent très peu de la notation de DESCARTES. Il est dès lors curieux de constater que les symboles d'égalité employés respectivement par DESCARTES et HUGO DE OMERIQUE sont presque semblables aux deux signes astronomiques qui correspondent aux équinoxes, à savoir le Bélier et la Balance.

Ce symbole $\_\wedge\_$ est assez difficile à écrire. Il se compose de quatre traits brisés. A-t-on déjà noté que les quelques rares symboles mathématiques élémentaires qui sont universellement adoptés aujourd'hui ne comprennent jamais plus de trois traits ?

J'ai cru devoir attirer spécialement l'attention sur le symbole dû à HUGO DE OMERIQUE, parce qu'il ne figure pas dans la monumentale *History of Mathematical Notations* que le Professeur CAJORI a récemment publiée (5).

(5) *A History of Mathematical Notations*, by FLORIAN CAJORI, 2 vol., 1928 and 1929. Cf. vol. 1, pp. 297-309 et en particulier paragraphe 264. (*Isis*, 12, 332-36; 13, 129).

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Il importe peu, au fond, de savoir si NEWTON a décerné un simple certificat de complaisance à l'ouvrage du mathématicien espagnol, ou si son appréciation était justifiée. Mais on peut se réjouir que l'apparition de ce manuel lui ait fourni l'occasion de révéler sa pensée sur un sujet sur lequel il s'est montré sobre de renseignements. Nulle part, semble-t-il, il ne s'est exprimé aussi clairement, encore que trop brièvement dans la forme où j'ai retrouvé ce brouillon de lettre.

Si NEWTON, par l'époque où il a vécu, appartient en fait à cette phase de la pensée mathématique qu'on a pu appeler l'âge de la synthèse algébrico-logique, les affinités profondes de son œuvre avec la pensée mathématique grecque méritent d'autant plus d'être soulignées que l'unité de physionomie de l'œuvre mathématique des Grecs est indéniable (6) et qu'au dix-septième siècle aussi, on n'admet point que la science grecque eût rien emprunté à l'Orient.

« Les Grecs, dit PIERRE BOUTROUX (7), ont recherché et cultivé en Mathématiques ce qui est *simple*, ce qui est *beau*, ce qui est *harmonieux*. » (Il vaut la peine de faire remarquer que ce sont là les termes mêmes dont se sert NEWTON : « simple & elegant »). Ainsi, un des traits distinctifs de la mathématique grecque est son caractère arbitraire et c'est précisément contre cet aspect artificiel et arbitrairement limité qu'un esprit aussi systématiquement logique et généralisateur que DESCARTES ne pouvait manquer de se rebeller : « Rien ne nous détourne davantage de la vérité que de diriger nos efforts vers des buts particuliers, au lieu de les tourner vers cette fin unique et générale » (8). C'est en refusant de s'en tenir à la stricte intuition des Grecs que DESCARTES a été amené à l'algèbre moderne (9). Avec quelle injuste sévérité il s'exprime sur les Anciens : ... « semblables à quelques artisans qui cachent leur secret, ils ont craint peut-

(6) C'est une des conclusions les plus remarquables qui se dégagent des travaux de PAUL TANNERY.

(7) *L'idéal scientifique des Mathématiciens*; Paris, ALCAN, 1920; p. 45.

(8) *Règles pour la direction de l'esprit;* règle première.

(9) Nous ne parlons ici bien entendu que des tendances générales du grand philosophe : très souvent il est revenu à la géométrie pure et à des démonstrations inspirées d'ARCHIMÈDE.

être que la facilité et la simplicité de leur méthode, en les popularisant, n'en diminuât l'importance, et ils ont mieux aimé se faire admirer en nous laissant, comme produit de leur art, quelques vérités stériles subtilement déduites, que de nous enseigner cet art lui-même, dont la connoissance eût fait cesser toute notre admiration ». (10) Le but de DESCARTES est de rompre avec la tradition grecque; c'est d'ailleurs en cela qu'il se différencie nettement de FERMAT. « Celui qui suivra attentivement ma pensée, dit-il encore, verra que je n'embrasse ici rien moins que les mathématiques ordinaires, mais que j'expose une autre méthode, dont elles sont plutôt l'enveloppe que le fond. » (11) LEIBNIZ — dont la technique de l'œuvre mathématique et celle de DESCARTES procèdent d'une même conception — rêvait dans sa jeunesse d'une Combinatoire Universelle qui eût été une étude formelle et a priori des différentes combinaisons qu'engendrent les opérations de l'arithmétique. Or, c'est parce que l'algèbre, langue symbolique universelle, est essentiellement une méthode qu'elle ne pouvait séduire un esprit anglais. Il n'est pas difficile de montrer qu'en dernière analyse, ce qu'il y a surtout de commun à NEWTON et aux Grecs, c'est l'absence de méthode (12).

Quel sens faut-il conférer à l'expression « the Analysis of the Ancients » (13) dans le texte qui fait l'objet de cet article ? « L'Ana-

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(10) *Règles pour la direction de l'esprit;* règle quatrième.

(11) *Ibid.*

(12) Signalons ici que NEWTON se rencontre sur plus d'un point avec FERMAT, qui, bien loin de déconsidérer la géométrie antique, avait une prédilection remarquable pour les cas particuliers portés à leur plus haut degré d'achèvement. Le parallèle avec le géomètre toulousain peut être poussé plus loin encore. La ressemblance est tout-à-fait surprenante si l'on songe que « bien que la publication des travaux de DESCARTES ait été la première en date, il est incontestable que, de son côté, spontanément, et sans doute à peu près à la même époque, FERMAT avait trouvé ce que beaucoup considèrent comme l'essentiel de la géométrie cartésienne » (G. MILHAUD, *Nouvelles études sur l'histoire de la pensée scientifique;* Paris, ALCAN, 1911, p. 160). MILHAUD a fort bien mis en relief la raison pour laquelle il n'y eut cependant pas, à propos de la priorité de la découverte, de querelle entre DESCARTES et FERMAT, semblable à la dispute fameuse entre LEIBNIZ et NEWTON. Cette raison est la suivante : la géométrie analytique était manifestement l'œuvre des Grecs. Le fait que NEWTON et LEIBNIZ furent en réalité vis-à-vis des anciens dans des conditions absolument identiques à celles où se trouvaient DESCARTES et FERMAT fait mieux ressortir le caractère de leur querelle.

(13) « ... pour l'Analyse des anciens & l'Algebre des modernes, outre qu'elles ne s'estendent qu'a des matieres fort abstractes, & qui ne semblent d'aucun usage, la premiere est toujours si astrainte a la consideration des figures, qu'elle

lyse, écrit OZANAM (14), consiste plus dans le jugement & dans l'adresse de l'esprit que dans les regles particulieres, lorsque l'on s'en sert par la pure Geometrie, comme faisoient les Anciens : Mais à present on s'en sert par l'Algebre, qui est une regle assurée pour venir à la fin de ce que l'on se propose ». Ainsi, une association d'idée toute naturelle a pu conduire certains auteurs à regarder les termes analyse et algèbre comme strictement équivalents. C'est ce que fait NEWTON, notamment dans les lignes inédites qu'on vient de lire. Nous pouvons écarter délibérément le sens d'opérations arithmétiques, une des deux significations qui se sont attachées dans l'antiquité aux mots analyse et synthèse, pour ne garder que celle plus importante de modes de démonstration ou d'invention; et le lecteur sait que dans ce dernier cas les mots analyse et synthèse ont servi à désigner trois modes différents. Mais il est évident qu'il n'est pas question ici de l'analyse zététique (invention des solutions; c'est le procédé fondamental de la méthode analytique moderne) ou de la rétique exégétique de VIÈTE. NEWTON songe à l'analyse poristique, qui consiste en l'invention d'une démonstration pour une solution ou une proposition énoncée. Par la Poristique, dit VIÈTE, on examine, au moyen de l'égalité ou de la proportion, la vérité d'un théoréme énoncé; et, comme P. TANNERY l'a fait remarquer avec beaucoup de justesse, « l'analyse poristique n'est pas une méthode, en ce sens qu'elle ne se prête point à une systématisation qui lui soit propre » (15).

Mais il y a plus. Alors qu'à aucun moment le géomètre grec ne fait abstraction de la forme des figures et de leur situation dans l'espace, la pratique de l'algèbre nécessite un grand pouvoir d'abstraction. L'algébriste doit faire table rase de la réalité pour opérer sur des symboles dont la nature lui demeurera indifférente (16). Il lui faut oublier la signification des éléments com-

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ne peut exercer l'entendement sans fatiguer beaucoup l'imagination; et on s'est tellement assuieti, en la derniere, a certaines reigles & a certains chiffres, qu'on en a fait un art confus & obscur, qui embarasse l'esprit, au lieu d'une science qui le cultive ». (DESCARTES, *Discours de la méthode*; édition ADAM et TANNERY; t. 6, pp. 17-18). L'expression « Analyse des anciens » est évidemment employée ici dans le sens de géométrie.

(14) *Dictionnaire mathématique*, 1691, p. 15.

(15) P. TANNERY : *Mémoires scientifiques*, t. 3, pp. 162-169.

(16) DESCARTES fut le premier, semble-t-il, à s'apercevoir que l'on peut raisonner

binés pour ne plus accorder son attention qu'au mécanisme de la combinaison; et, en fait, l'analyse moderne nous élève, sans effort, grâce à l'algèbre, à un degré d'abstraction que ne soupçonnèrent pas les Grecs, en dépit des tendances contemplatives de leur géométrie. Or, de nombreux indices tendent à faire croire que NEWTON n'a pu raisonner sur des grandeurs sans se les représenter. L'algèbre, à première vue, en tant que technique strictement utilitaire, pouvait paraître, par la sûreté et la rapidité de ses résultats, plus apte à tenter un esprit anglais, épris avant tout du pratique. Cependant « le principal but de la géométrie est de faciliter les méthodes de pratique » (17). Le caractère mécanique de l'algèbre et tout ce que cette science implique par sa généralité est opposé à ce qui est « ingenious & elegant ». « C'est par une innovation des modernes qu'on y a fait entrer (dans la géométrie) des multiplications, des divisions, et d'autres calculs de cette espèce; et cette innovation n'est point heureuse; elle répugne aux premiers principes de la science. Car si l'on réfléchit bien aux constructions des problèmes par la ligne droite et le cercle, telles que les ont imaginées les anciens géomètres, on verra facilement qu'ils n'y ont eu recours qu'afin d'éviter, par le tracé facile de quelques lignes, l'ennui des longs calculs. Il ne faut donc pas confondre ces deux sciences; les anciens en séparaient les limites avec tant de soin, que jamais ils ne se sont permis d'introduire des termes d'arithmétique dans la géométrie; et les modernes en les confondant, ont fait disparaître la simplicité qui fait toute l'élégance de la géométrie » (18).

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sur des quantités purement abstraites. Comme l'a judicieusement noté le P. BOSMANS : « L'esprit clair et rigoureux du peuple hellène, ennemi déclaré de ce langage mathématique conventionnel que nous affectionnons tant, ne pouvait songer à donner un sens général aux lettres comme nous y sommes habitués en algèbre. L'algèbre avait, on le sait, chez eux une forme entièrement géométrique. » (Préface à *La science égyptienne* par O. GILLAIN, 1927, p. VIII).

(17) *Arithmétique universelle*, édition BEAUDEUX, 1802, t. 2, p. 89.

(18) *Ibid.*, p. 56. Voici, extraits du même ouvrage, encore deux passages suggestifs :

« Au reste, je ne partage pas leur opinion à cet égard (l'opinion des géomètres modernes). Leur règle, qui est d'admettre pour la construction des problèmes toutes les espèces de lignes, selon le rang des dimensions de leurs équations, me paraît arbitraire, et sans aucune base solide en géométrie. Je dis plus même, c'est qu'elle est fausse; car, selon cette règle, le cercle serait du même ordre que les sections coniques, et cependant on s'accorde généralement à le ranger avec la ligne droite; et la certitude de cette règle une fois ébranlée, que devient celle d'admettre

Au surplus, les progrès de l'algèbre étaient souvent insuffisants au point que dans ses recherches sur les sections coniques, NEWTON fut obligé de recourir à APOLLONIUS. Le caractère utilitaire des mathématiques appliquées chez les Grecs se retrouve dans le traité d'algèbre auquel — chose remarquable — a été donné le nom d'*Arithmétique universelle*. En particulier, les titres pittoresques de quelques problèmes résolus dans cet ouvrage semblent directement empruntés aux traités grecs. Comme avec NEWTON, qui d'ailleurs appréciait beaucoup les travaux du philosophe français, nous sommes éloignés de l'idée chère à DESCARTES que la mathématique universelle a pour objet l'explication de l'univers; cette conception synthétiste de la science chez l'auteur du *Discours de la méthode* fait volontiers songer à la « raideur » du *Timée*. NEWTON, lui, ne veut pas rompre avec le passé comme font DESCARTES et LEIBNIZ. Mais, bien plus peut-être qu'il n'est attiré par les qualités de la mathématique grecque, ce sont les caractères mêmes de l'algèbre qui ne peuvent lui plaire, puisque cette technique ne peut étendre sa portée et son action qu'en s'abstrayant de la réalité.

J'ai déjà eu l'occasion (19) d'insister sur le fait que l'activité mathématique de NEWTON n'a constitué qu'un épisode de sa carrière. C'est que, à l'inverse du mathématicien de l'école algébriste féru surtout de méthodes, il attache plus de prix aux théories applicables à la physique. Son ambition est de connaître des faits nouveaux. Il ne s'est pas préoccuppé de savoir si la science était une synthèse algébrico-logique. Pour lui, l'analyse infinitésimale n'a jamais été qu'un expédient; d'ailleurs, elle ne contenait aucun principe nouveau opposé à ceux qui étaient à la base de l'algèbre finie. La diminution du rôle de l'algèbre dans l'analyse moderne constitue une nouvelle preuve, tardive mais cer-

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dans la géométrie toutes les lignes, selon l'ordre de leurs dimensions? N'est-elle pas sapée par les fondemens? » (pp. 85-86).

« Rien n'est donc plus dénué de fondement que cette classification des courbes selon la simplicité de leurs équations, et les géomètres modernes y ont trop d'égard. La simplicité des équations n'est qu'une simplicité analytique qui n'a rien de commun avec la composition. Les loix de celles-ci sont entièrement indépendantes de l'analyse : cette dernière nous mène comme par la main à la composition ; mais il n'y a de vraie composition qu'à l'instant où l'analyse a entièrement disparu, tant qu'il en reste la moindre trace, vous n'avez point encore de véritable composition » (pp. 89-90). Voir aussi : *Principia*, livre I, lemme 19, cor. 2.

(19) « Une lettre inédite de NEWTON »: *Isis*, vol. 12, n° 38; cf. pp. 240, 248 et 249.

taine, de l'intuition géniale de NEWTON sur la voie à suivre. Comme me l'écrivait Sir JOSEPH LARMOR dans une lettre récente : « In fundamentals geometry is *still* the essential key ». On peut remarquer encore que la méthode de recherche de NEWTON en mathématiques n'est pas autre chose au fond que la méthode expérimentale. L'on songe à PYTHAGORE, qui, représentant les nombres par des points rangés en ligne, constate que le produit d'un nombre par lui-même est figuré par un carré (20).

Peut-être le lecteur des brèves considérations ci-dessus inclinera-t-il à penser que les principes introduits par NEWTON n'ont pas eu sur la pensée mathématique toute l'influence qu'on leur attribue communément.

Harvard University. JEAN PELSENEER
(Fellow of the C. R. B.
Educational Foundation).

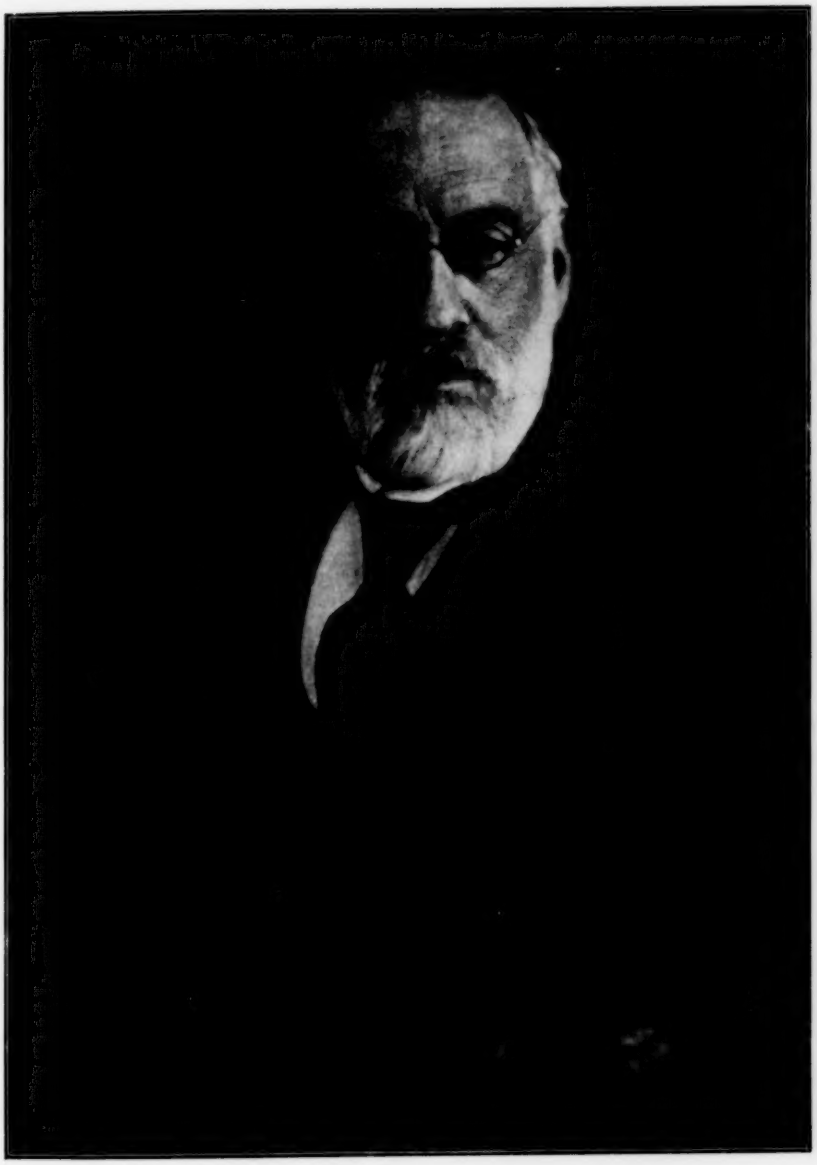
(20) Il est certain que l'antiintellectualisme de NEWTON se manifeste surtout en physique, par contraste notamment avec l'attitude de DESCARTES, qui, lui, réduit la matière à n'être que l'objet des exercices de la pure raison (Cf. par exemple : *Principes de la Philosophie*, 2e partie, 20). L'histoire aussi se charge de nous montrer que c'est l'essence même de l'intellectualité que d'être superficielle.

Eilhard Wiedemann

geb. 1. August 1852 — gest. 7. Januar 1928.

Aussergewöhnliche schöpferische Begabung und Bildung, vereint in einer geläuterten Persönlichkeit, sind immer Kostbarkeiten des Menschengeschlechtes gewesen. Sie machen sich mit innerer Folgerichtigkeit, äusserlich oft unbeachtet, im geistigen Antlitz einer Epoche geltend und haben ihren Wert unabhängig davon, ob der Name, an den sie gebunden sind, mit einer besonders fruchtbringenden Einzelleistung oder-entdeckung verknüpft ist. In diesem Gedanken seien die nachfolgenden Zeilen dem Andenken von EILHARD WIEDEMANN gewidmet.

EILHARD WIEDEMANN entstammt einer bekannten Gelehrtenfamilie, deren Begabung und Geistigkeit sich auf ihn in selten glücklicher Weise vererbt hat. Er wurde am 1. Aug. 1852 zu Berlin geboren als Sohn des damaligen Privatdozenten der Physik, GUSTAV WIEDEMANN, eines der hervorragendsten Physiker des 19. Jahrhunderts, und dessen Frau CLARA, geb. MITSCHERLICH, Tochter des Berliner Chemikers, des bekannten Entdeckers der Isomorphie. In Basel, Braunschweig und Karlsruhe, wo der Vater die Professur für Physik bekleidete, besuchte der junge EILHARD das Gymnasium. In Karlsruhe schloss er die Schulzeit mit einem glänzend bestandenen Abiturientenexamen ab. Darauf studierte er in Heidelberg Mathematik, Physik und Chemie. Seine Lehrer waren HELMHOLTZ, BUNSEN, KÖNIGSBERGER und besonders KIRCHHOFF. Das Studium beendete WIEDEMANN in Leipzig, wohin sein Vater inzwischen berufen worden war; hier promovierte er im Jahre 1872 mit einer bereits in Heidelberg begonnenen Arbeit: « Ueber die elliptische Polarisation des Lichtes und ihre Beziehungen zu den Oberflächenfarben der Körper ». Daran schloss sich im Jahre 1876 die Habilitation an der Universität Leipzig. Bereits zwei Jahre später erhielt der junge Forscher,



EILHARD WIEDEMANN (1852-1928)

Isis, XIV, pl. 5

H. J. SEEMANN

der durch eine Reihe bemerkenswerter Untersuchungen hervorgetreten war, den Titel eines ausserordentlichen Professors. Ostern 1886 erfolgte die Berufung als ordentlicher Professor nach Darmstadt und im Herbst des gleichen Jahres an die Universität Erlangen. Hier wirkte WIEDEMANN, zugleich als Direktor des physikalischen Instituts, 40 Jahre lang bis zu seinem Übertritt in den Ruhestand, Ostern 1926.

Während seiner Erlanger Zeit entfaltete WIEDEMANN eine sehr segensreiche Tätigkeit. Mit ausgezeichneten Experimentalarbeiten von dauerndem Wert, die er grossen Teils mit seinen Assistenten (vor allem H. EBERT, G. C. SCHMIDT und A. WEHNELT) ausführte, nahm er an der Entwicklung der Physik bis zur Jahrhundertwende teil. Auch danach, als er das eigene physikalische Arbeiten aufgegeben hatte, wurden aus dem Erlanger Institut bis in die neueste Zeit wertvolle physikalische Arbeiten veröffentlicht, die zu einem guten Teil auf Anregung von WIEDEMANN entstanden sind. Die Bedeutung dieser Arbeiten hat einer seiner ältesten Schüler, Prof. Dr. G. C. SCHMIDT in Münster i. Westf., in seinem Nachruf auf WIEDEMANN (*Physikalische Zeitschrift* 29. Jahrg. (1928), S. 185) gewürdigt. Ich darf es mir versagen, seinen Worten weitere hinzuzufügen, da diese aus der Feder eines Mannes stammen, der lange Jahre mit WIEDEMANN zusammengearbeitet hat und die Entwicklung der Physik während der letzten Jahrzehnte aus eigener Anschauung kennt.

WIEDEMANNS Verdienste um die Physik sind mit seinen Arbeiten aber noch nicht erschöpft. Auf seine Anregung hin wurden im Jahre 1877 die *Beiblätter zu den Annalen der Physik* begründet. Sie sollten in kurzen Referaten den wesentlichen Inhalt aller ausländischen und der schwerer zugänglichen inländischen Arbeiten wiedergeben. Die Beiblätter wurden von GUSTAV und EILHARD WIEDEMANN 24 Jahre lang herausgegeben. Sie gingen dann auch dem Tode des Vaters ebenso wie die *Annalen* selbst, an deren Redaktion EILHARD seit 1893 ebenfalls teilgenommen hatte, in andere Hände über. — Schliesslich sei noch erwähnt, dass WIEDEMANN der Herausgeber der im Verlag Vieweg in Braunschweig erscheinenden Sammlung « Die Wissenschaft » war.

Schon während der Zeit, als seine Tätigkeit noch fast ganz in der physikalischen Forschung aufging, hat sich WIEDEMANN bereits mit der Geschichte der Naturwissenschaften, vornehmlich

im arabischen Zeitalter, befasst. Von 1876 an hat er hierüber kleinere Mitteilungen veröffentlicht. (Vgl. die Literaturzusammenstellung am Schluss). Persönliche Enttäuschungen, die durch die Nichtanerkennung seiner bis dahin zweifellos bedeutenden Verdienste um die Physik verursacht waren, sowie seine geschwächte Gesundheit veranlassten ihn etwa um die Jahrhundertwende, das eigene experimentelle Arbeiten aufzugeben und sich allmählich ganz der historischen Forschung zu widmen. Ein Blick auf das Verzeichnis seiner historischen Arbeiten zeigt, in welch auffallendem Masse etwa von 1906 an seine Produktion auf diesem Gebiete zunimmt. In den Kreisen seiner Kollegen hat WIEDEMANN mit den historischen Forschungen oft nur wenig Verständnis gefunden; man dachte wohl auch an den formalen Gegensatz zu den Verpflichtungen, die ihm seine Stellung als Vertreter der Experimentalphysik und als Leiter eines für experimentelle physikalische Arbeiten bestimmten Instituts auferlegte. Wie dem auch sei, solche « zunftgemässe » Einwände oder Geringschätzungen müssen verstummen gegenüber den unschätzbaren Werten, die WIEDEMANNS historische Arbeiten enthalten. Und dies um so mehr, als die Vorbedingungen für solche Arbeiten, nämlich ungewöhnliche Sprachbegabung zusammen mit vielseitigen naturwissenschaftlichen Kenntnissen, nur ganz selten bei einem Menschen vereint sind. Es ist daher für die Wissenschaft ein Glück gewesen, dass WIEDEMANN diese Fähigkeiten, die er in so einzigartiger Weise besass, an der richtigen Stelle eingesetzt hat. Dass ein Physiker, der sich als Experimentator ersten Ranges erwiesen hatte, sich auf die Geschichte dieser und der übrigen Naturwissenschaften wirft, ist eine Tat, die gewiss in der Zukunft mehr als heute gewürdigt werden wird. In unserer Zeit, da die unerhörte Entwicklung der Naturwissenschaft eine starke Zersplitterung derselben in vielerlei Einzelzweige hervorgerufen hat, droht die Gefahr, dass die grossen geistigen Entwicklungslinien immer undurchsichtiger werden. Die Geschichte der Wissenschaft lenkt dagegen die Aufmerksamkeit wieder auf die umfassenden Gesichtspunkte hin und ist daher in der heutigen Zeit doppelt notwendig. So wird EILHARD WIEDEMANN in der Reihe der Männer, die in diesem Geiste der Wissenschaft dienten, stets einen Ehrenplatz einnehmen.

Mit bewunderungswürdigem Fleiss hat WIEDEMANN aus den

arabischen Manuskripten die naturwissenschaftlichen Kenntnisse der Araber zusammengetragen. Allein in seinen bekannten *Beiträgen zur Geschichte der Naturwissenschaften*, in denen er laufend über die Ergebnisse seiner Studien berichtet hat, findet man eine Fülle von historischem Material. Später hat er einzelne Fragen zusammenfassender behandelt, ich erwähne besonders sein mit F. HAUSER herausgegebenes Werk : « Ueber die Uhren im Bereich der islamischen Kultur. » Ausführlich hat er sich auch mit den astronomischen Instrumenten der Araber befasst; hierüber sind teils von ihm, teils von seinen Mitarbeitern eingehende Untersuchungen erschienen. Um die Ergebnisse der grösseren Arbeiten einem weiteren Kreis zu vermitteln, hat er die Herausgabe der *Abhandlungen zur Geschichte der Naturwissenschaften und der Medizin* (im Verlag M. MENCKE, Erlangen) veranlasst, deren Weiterführung nach seinem Tode leider fraglich werden dürfte. Von seinen Assistenten haben sich an den geschichtlichen Forschungen, teils mit WIEDEMANN zusammen, teils selbständig, beteiligt : in erster Linie F. HAUSER, J. FRANK und J. WÜRSCHMIDT, in den letzten Jahren auch K. KOHL, TH. MITTELBERGER und H. J. SEEMANN. Daneben enstanden mehrere Dissertationen, deren Ausführung WIEDEMANN noch während seines Ruhestandes geleitet hat.

Überblickt man die Leistungen von EILHARD WIEDEMANN als Historiker der Naturwissenschaften, so muss man mit Bedauern feststellen : Die Krönung seines Lebenswerkes, die Zusammenfassung seiner Forschungen in einem grossen Werk über die Naturwissenschaften im arabischen Zeitalter, steht noch aus. Nur ein Mann von den umfassenden Kenntnissen, wie er sie besass, könnte diese Arbeit an seiner Stelle übernehmen. Hoffen wir, dass der Wunsch, dies möge bald geschehen, in Erfüllung geht.

Als Lehrer besass WIEDEMANN ausgezeichnete Eigenschaften. Durch seinen ungemein lebendigen Geist, durch seinen nie ermüdenden Fleiss, durch seine Gewissenhaftigkeit, durch sein geradezu fabelhaftes Gedächtnis war er ein schönes Vorbild für die Jugend. Ich habe ihn, als sein letzter Assistent, erst im hohen Alter kennen gelernt und hatte beim Arbeiten mit ihm stets aufs neue Gelegenheit, diese Eigenschaften zu bewundern. Ich habe mir ihn oft jünger gewünscht, um recht lange unter seinem Ein-

fluss bleiben zu können. In seiner Art lag etwas Hinreissendes, dem man sich nicht leicht entziehen konnte. Wenn Schwierigkeiten auftraten, so war er stets hilfsbereit wie ein guter Freund. Wenn auch sein Kolleg zu der Zeit, als ich es hörte, sachlich nicht mehr ganz auf der Höhe der Zeit stand, so fesselte doch sein geistvoller und sprachlich ungemein fein geformter Vortrag. Vorbildlich — die meisten seiner Kollegen hätten daran lernen können — war sein Streben, die Erscheinungen einfach und klar zu erläutern, das Wesentliche herauszuschälen, Ungeklärtes und Schwieriges fortzulassen. Er hatte ein selten feines Empfinden dafür, was man einem Lernenden zumuten kann; er war ein eifriger Gegner der Bestrebungen, die studierende Jugend immer wieder mit neuen Anforderungen zu belasten. Wiederholt betonte er die Wichtigkeit, den Studierenden möglichst bald mit selbständiger Arbeit zu betrauen.

Die eingehende Beschäftigung WIEDEMANNS mit der Ausbildung der Studierenden in der Physik fand ihren Niederschlag in seinem bekannten, mit H. EBERT herausgegebenen Buch : «Physikalisches Praktikum», das unter Mitwirkung von A. WEHNELT im Jahre 1924 in 6. Auflage erschienen ist. Es ist im Anschluss an das zu Beginn seiner Erlanger Tätigkeit eingerichtete Anfängerpraktikum entstanden, das damals eine Neuerung war, heute aber wohl Gemeingut aller physikalischen Institute an den deutschen Hochschulen geworden ist.

Für die Fragen des naturwissenschaftlichen Unterrichtes an den höheren Schulen hatte WIEDEMANN sein Leben lang grosses Interesse; er hat sich in dieser Richtung wiederholt schriftstellerisch betätigt. Von der bayerischen Regierung, bei der er sich hohen Ansehens erfreute, wurde er oft als Kommissar zur Abhaltung von Reifeprüfungen berufen; dabei glänzte er immer durch seine erstaunlichen Kenntnisse auf den verschiedensten Gebieten.

Ein trefflicher Beweis für WIEDEMANNS hervorragende Eignung zum Lehrer und Förderer des akademischen Nachwuchses ist die Tatsache, dass aus dem kleinen Erlanger Institut eine im Vergleich zu anderen Universitäten auffallend grosse Zahl von späteren Professoren der Physik hervorgegangen ist, die zum Teil Forscher von anerkanntem Ruf geworden sind, genannt seien : H. EBERT, J. FRANK, H. GEIGER, W. MATTHIES, R. REIGER, G. C. SCHMIDT, H. TH. SIMON, A. WEHNELT, J. WÜRSCHMIDT.

Dies ein kurzes Bild von EILHARD WIEDEMANN im Dienste der Wissenschaft. Dem harmonischen Zusammenleben mit der Familie war der Mensch bestimmt : der liebenden Gattin, die mit ihm Freud und Leid, das ihm nicht erspart blieb, bis zu seinem Tode geteilt hat, den vier Söhnen, die alle für Deutschland, das er so sehr liebte, gekämpft und geblutet haben und sich zu seiner Freude entwickelten. Aber auch von den vielen, denen EILHARD WIEDEMANN menschlich näher getreten ist, wird ihm mancher ein treues Andenken bewahren, vor allem seine Schüler, um deren persönliches Wohlergehen er sich stets bekümmerte, denen er durch seine ernste Lebensauffassung, durch sein gütiges, wahrhaftes Wesen und durch gewissenhafte Pflichterfüllung dauernd ein Vorbild sein wird.

Anschliessend folgt eine möglichst vollständige Zusammenstellung der historischen Arbeiten von E. WIEDEMANN, die allerdings den Nachlass, der mir nicht zugänglich gemacht werden konnte, nicht enthält. Ich hoffe, dass die mühevolle Arbeit, der sich meine liebe Braut mit grosser Umsicht unterzogen hat, für die in der Geschichte der Naturwissenschaften tätigen Gelehrten von Nutzen sein wird. Von einer Zusammenstellung der physikalischen Arbeiten E. WIEDEMANN's sehe ich ab; diese sind in den einschlägigen Zeitschriften und Referatenblättern leicht einzusehn.

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In : « Studien zur Geschichte der Chemie », Festgabe für O. v. LIPPMANN von der deut. Ges. f. Gesch. d. Med. u.d. Naturwissenschaften (1927), S. 48.

Es folgt nun die Reihe von Arbeiten, die unter dem Sammeltitel : « Beiträge zur Geschichte der Naturwissenschaften » in den *Sitzungsberichten der Physikalisch-Medizinischen Sozietät zu Erlangen* veröffentlicht sind. Diese Arbeiten sind mit römischen Buchstaben nummeriert; nach der Titelangabe folgen Band, Jahres- und Seitenzahl der Veröffentlichung in den Sitzungsberichten. Zum Zweck einer brauchbaren Uebersicht über die behandelten Gegenstände habe ich bei einer Reihe von Beiträgen, wo es sich als notwendig erwies, die Titel der einzelnen Unterabschnitte angegeben.

I. Beiträge zur Geschichte der Chemie bei den Arabern.
Bd. 34 (1902), S. 45.

II. Bd. 36 (1904), S. 309.
1) Einleitung.
2) Ueber elektrische Erscheinungen.
3) Ueber Magnetismus.
4) Optische Beobachtungen.
5) Ueber einige physikalische usf. Eigenschaften des Goldes.
6) Zur Geschichte der Chemie.

III. Bd. 37 (1905), S. 218.
1) Einleitung.
2) Besprechung eines Stückes aus der Beschreibung Aegyptens von AL KINDÎ und der darin erwähnten Gelehrten.
3) Ueber den Brief « Das goldene Haus » von ARISTOTELES.
4) Bemerkungen zur Astronomie und Kosmographie der Araber.
5) Einige Biographien von griechischen Gelehrten nach QIFTÎ.
6) Ueber die Kenntnis von Uhren bei den Arabern.

IV. Ueber Wagen bei den Arabern.
Bd. 37 (1905), S. 388.

V. Auszüge aus arabischen Enzyklopädien und anderes.
1) Uebersetzung und Besprechung der Abhandlung über die Geometrie aus AL ANSÂRÎ's IRSCHÂD AL QÂSID.
2) Auszüge aus IBN SÎNÂ's Teile der philosophischen (mathematischen) Wissenschaften.
3) Auszüge aus dem Abschnitte über Naturwissenschaften von IBN SÎNÂ und AL ANSÂRÎ.
4) Biographien griechischer Gelehrter.
5) Zusätze zu früheren Mitteilungen.
Bd. 37 (1905), S. 392.

VI. Zur Mechanik und Technik bei den Arabern.
Bd. 38 (1906), S. 1.

VII. Ueber arabische Auszüge aus der Schrift des ARCHIMEDES über die schwimmenden Körper.
Bd. 38 (1906), S. 152.

VIII. Ueber Bestimmung der spezifischen Gewichte.
Bd. 38 (1906), S. 163.

IX. Zu der Astronomie bei den Arabern.
Bd. 38 (1906), S. 181.

X. Zur Technik bei den Arabern.
Bd. 38 (1906), S. 307.

XI. Ueber AL FÂRÂBÎ's Aufzählung der Wissenschaften (de scientiis).
Bd. 39 (1907), S. 74.

XII. Ueber Lampen und Uhren.
Bd. 39 (1907), S. 200.

XIII. Ueber eine Schrift von IBN AL HAIṬAM : « Ueber die Beschaffenheit der Schatten. »
Bd. 39 (1907), S. 226.

XIV. 1) Ueber die Geometrie und Arithmetik nach den Mafâtîḥ al 'Ulûm.
2) Ueber die Arithmetik nach IBN AL AFKÂNÎ.
3) Nachrichten über Zahlenzeichen.

4) Ueber das Schachspiel und dabei vorkommende Zahlenprobleme. Nachträge.
Bd. 40 (1908), S. 1.

XV. Ueber die Bestimmung der Zusammensetzung von Legierungen.
Bd. 40 (1908), S. 105.

XVI. Ueber die Lehre vom Schwimmen, die Hebelgesetze und die Konstruktion des Qarasṭûn.
Bd. 40 (1908), S. 133.

XVII. 1) Eine philosophische Studie von IBN AL HAIṬAM über den Ort.
2) Ein von IBN AL HAIṬAM gelöstes Zahlentheorem.
3) Ueber eine Berichtigung von IBN AL HAIṬAM zu einem Satz des BENÛ MÛSÂ.
4) Ueber das Messen von IBN AL HAIṬAM.
Bd. 41 (1909), S. 1.

XVIII. 1) Astronomische Instrumente.
2) Ueber trigonometrische Grössen.
3) Geodätische Messungen.
Bd. 41 (1909), S. 26.

XIX. Ueber die Brechung des Lichtes in Kugeln nach IBN AL HAIṬAM und KAMÂL AL DÎN AL FÂRISÎ.
Bd. 42 (1910), S. 15.

XX. Einige Biographien nach AL BAIHAQÎ.
Bd. 42 (1910), S. 59.

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B) Ueber Vermessung nach IBN MAMMÂTÎ.
Bd. 42 (1910), S. 294.

XXII. Stücke aus den Mafâtîḥ al 'Ulûm.
Bd. 42 (1910), S. 303.

XXIII. Einiges aus AL GAUBARÎ. (Verfälschung von Lebensmitteln.)
Bd. 42 (1910), S. 310.

XXIV. Zur Chemie bei den Arabern. (Dieser Beitrag gibt eine Uebersetzung des Abschnittes über Chemie aus den Mafâtîḥ.)
Bd. 43 (1911), S. 72.

XXV. Ueber Stahl und Eisen bei den muslimischen Völkern.
Bd. 43 (1911), S. 114.

XXVI. Ueber Scharlatane bei den Muslimen nach AL GAUBARÎ.
Bd. 43 (1911), S. 206.

XXVII. 1) Geographisches von AL BÎRÛNÎ.
2) Auszüge aus AL SCHÎRÂZÎ's Werk über die Astronomie.
3) Ueber die Grösse der Meere nach AL KINDÎ.
4) Geographische Stellen aus den Mafâtîḥ.

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XXIX. Geographisches aus dem mas'ûdischen Kanon von AL BÎRÛNÎ. (Mit I. HELL.)
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1) Uebersetzung des Werkes von IBN AL AKFÂNÎ über Mineralogie.
2) Mineralogisches aus einer arabischen Handels- und Warenlehre.
3) Bemerkungen über einzelne Edelsteine, Mineralien, Mineralvorkommen.
Bd. 44 (1912), S. 205.

XXXI. Ueber die Verbreitung der Bestimmungen des spezifischen Gewichtes nach BÎRÛNÎ.
Bd. 45 (1913), S. 31.

XXXII. Aus der arabischen Handels- und Warenlehre von ABÛ'L FAḌL GA'FAR IBN 'ALÎ AL DIMASCHQÎ.
Bd. 45 (1913), S. 35.

XXXIII. Ueber optische Täuschungen nach FAHR AL DÎN AL RÂZÎ und NASÎR AL DÎN AL ṬÛSÎ.
Bd. 45 (1913), S. 154.

XXXIV. Ueber die Geschichte der Kubikelle usw., verschiedener Substanzen nach arabischen Schriftstellern.
Bd. 45 (1913), S. 168.

XXXV. Ueber Nivellieren.
Bd. 46 (1914), S. 15.

XXXVI. Ueber Musikautomaten.
Bd. 46 (1914), S. 17.

XXXVII. Ueber die Stundenwage.
Bd. 46 (1914), S. 27.

XXXVIII. Theorie des Regenbogen von IBN AL HAIṬAM.
Bd. 46 (1914), S. 39.

XXXIX. Ueber die Camera obscura bei IBN AL HAIṬAM.
Bd. 46 (1914), S. 155.

XL. 1) Ueber Verfälschungen von Drogen usw. nach IBN BASSÂM und NABARÂWÎ.
2) Bemerkungen zu den im Abschnitt 1 erwähnten Substanzen usw.
3) Angaben von NABARÂWÎ und IBN BASSÂM über Wagen, Gewichte und Masse.
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XLI. Zur Geschichte des Zuckers.
Bd. 47 (1915), S. 83.

XLII. Zwei naturwissenschaftliche Stellen aus dem Werk von IBN HAZM über die Liebe, über das Sehen und den Magneten.
Bd. 47 (1915), S. 93.

XLIII. Naturwissenschaftliches aus IBN QUTAIBA.
Bd. 47 (1915), S. 101.

XLIV. Kleine Mitteilungen.
1) Bohren mit Diamant.
2) Meeresleuchten.
3) Gelehrige Affen und Elefanten.
4) Magnetberge.
5) Gestalt der (bewohnten) Erdoberfläche.
6) Leuchtkäfer und Glühwürmchen.
7) Ueber die Farben der Pfauenfeder.
8) Ueber den Zucker *al 'Uschar*. (Zucker des *al 'Uschar*.)
9) Ueber den Betrieb einer Wasseruhr. (Tagâr.)
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XLV. Zahnärztliches bei den Muslimen.
Bd. 47 (1915), S. 127.

XLVI. Darwinistisches bei GÂḤIẒ.
Bd. 47 (1915), S. 130.

XLVII. Ueber die Astronomie nach den Mafâtiḥ al'Ulûm.
Bd. 47 (1915), S. 214.

XLVIII. Ueber die Wage des Wechselns von AL CHÂZINÎ und über die Lehre von den Proportionen nach AL BÎRÛNÎ.
Bd. 48/49 (1916/17), S. 1.

XLIX. Ueber von den Arabern benutzte Drogen. (Unter Mitwirkung von A. GROHMANN).
Bd. 48/49 (1916/17), S. 16.

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LII. Ueber den Zucker bei den Muslimen.
Bd. 48/49 (1916/17), S. 177.

LIII. Ueber die Kriechtiere nach AL QAZWÎNÎ nebst einigen Bemerkungen über die zoologischen Kenntnisse der Araber.
Bd. 48/49 (1916/17), S. 228.

LIV. Uebersetzung und Besprechung des Abschnittes über die Pflanzen von QAZWÎNÎ.
Bd. 48/49 (1916/17), S. 286.

LV. Nachträge zu dem Aufsatz über den Zucker.
Bd. 48/49 (1916/17), S. 322.

LVI. Ueber Parfüms und Drogen bei den Arabern.
Bd. 48/49 (1916/17), S. 329.

LVII. Definitionen verschiedener Wissenschaften und über diese verfasste Werke.
1) Im Fihrist von AL NADÎM aufgeführte Werke.
2) Definitionen nach IBN SÎNÂ.
3) Definitionen nach AKFÂNÎ.
4) Definitionen nach Ḥ. CHALFA.
5) Aus der Schrift « Ueber die Wissenschaften » von AL TAUḤÎDÎ.
Bd. 50/51 (1918/19), S. 1.

LVIII. Bestimmung der Durchmesser der um und in regelmässige Vielecke beschriebenen Kreise und des Inhaltes von Flächen und Körpern, sowie Stücke einer Lehre al Gabr wa'l Muqâbala.
Bd. 50/51 (1918/19), S. 264.

LIX. Gefäss zum Regeln des Wasserausflusses bei Wasseruhren.
Bd. 50/51 (1918/19), S. 272.

LX. Ueber AL BÎRÛNÎ und seine Schriften. (Mit H. SUTER unter Mitwirkung von O. RESCHER.)
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LXI. Allgemeine Betrachtungen von AL BÎRÛNÎ in seinem Werk über die Astrolabien. (Mit J. FRANK unter Mitwirkung von M. HORTEN.)
Bd. 52/53 (1920/21), S. 97.

LXII. Zirkel zur Bestimmung der Gebetszeiten. (Mit J. FRANK.)
Bd. 52/53 (1920/21), S. 122.

LXIII. Zur Geschichte der Alchemie.
Bd. 52/53 (1920/21), S. 126.

LXIV. Ueber ṬABÎT BEN QURRA, sein Leben und Wirken.
Bd. 52/52 (1920/21), S. 189.

LXV. Ueber die Eigenschaften des Jâqût (Hyazinthes).
Bd. 52/53 (1920/21), S. 220.

LXVI. Zur Geschichte der Musik.
1) Abschnitt über die Musik aus den Schlüsseln der Wissenschaft.
2) Angaben von AL AKFÂNÎ über die Musik.
(Unter Mitwirkung von Dr. WILHELM MÜLLER.)
Bd. 54/55 (1922/23), S. 7.

LXVII. Alchimistische Decknamen.
1) Die Namen der sieben Körper. (Metalle).
2) Die Namen der sieben Geister.
(Mit J. RUSKA.)
Bd. 56/57 (1924/25), S. 17.

LXVIII. Ueber eine besondere Art des Gesellschaftsrechnens nach IBN AL HAIṬAM.
Bd. 58/59 (1926/27), S. 191.

LXIX. Einleitung von AL ZARQÂLÎ zu einer Schrift über die nach ihm benannte Scheibe. (Mit TH. MITTELBERGER.)
Bd. 58/59 (1926/27), S. 197.

LXX. Einleitung zu Werken von AL CHARAQÎ. (Mit KARL KOHL.)
Bd. 58/59 (1926/27), S. 203.

LXXI. Ueber eine Schrift: « Ueber die Bewegung des Rollens und die Beziehung zwischen dem Geraden und dem Gekrümmten » von QUṬB AL DÎN MAḤMÛD B. MAS'ÛD AL SCHÎRÂZÎ.
Bd. 58/59 (1926/27), S. 219.

LXXII. Einleitung zu dem astronomischen Teil des Kitâb al Schifâ. (Werk der Genesung von IBN SÎNÂ.)
Bd. 58/59 (1926/27), S. 225.

LXXIII. Zu der Redaktion von EUKLIDS Elementen durch NAṢÎR AL DÎN AL ṬÛṢÎ.
Bd. 58/59 (1926/27), S. 228.

LXXIV. Ueber die Milchstrasse bei den Arabern.
Bd. 58/59 (1926/27), S. 348.

LXXV. Zum Leben von NAṢÎR AL DÎN AL ṬÛṢÎ.
Bd. 58/59 (1926/27), S. 363.

LXXVI. Ueber astronomische Instrumente.
Bd. 58/59 (1926/27), S. 380.

LXXVII. Ueber die Schrift « Astronomica quaedam » von GREAVES. (Von R. RAMSAY WRIGHT mit einem Zusatz von E. WIEDEMANN.)
Bd. 58/59 (1926/27), S. 381.

LXXVIII. NAṢÎR AL DÎN AL ṬÛṢÎ.
Bd. 60 (1928), S. 289.

(Greifswald). H. J. SEEMANN.

Seven Salts of Hermes

In medieval manuscripts is found a work of alchemy ascribed to HERMES bearing the title, *Secrets according to the Nature of Transmutation or Of Salts and Bodies* (1) The treatise dates back to the thirteenth century if a manuscript at Brussels is correctly placed in that century. (2) The author, whoever he may really be, opens by pointing out that there are seven planets, seven metals,

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(1) Mrs. DOROTHEA WALEY SINGER, *Catalogue of Latin and Vernacular Alchemical Manuscripts in Great Britain and Ireland dating from before the XVI Century*, Brussels, 1928, No. 37, pp. 43-44, lists two Mss. of the fourteenth and three of the fifteenth century. Of these I had briefly mentioned the two 14th century Mss. in my *History of Magic and Experimental Science*, 1923, II, 218, note 3, but in the present connection I have chiefly examined All Souls 81, and can give a somewhat fuller description of it than is found in the catalogue just mentioned or in HENRY O. COXE's *Catalogus codicum Mss. qui in collegiis aulisque Oxoniensibus hodie adservantur*, 1852, II, 24. It seemed to me that our treatise covered only fols. 18v-20v, rather than 18v-52v, as suggested by COXE and Mrs. SINGER. The exact wording of the preceding Rubric or Titulus is, « Hic incipiunt secreta hermetis regis grecorum secundum transmutacionis naturam. » After the passage on salts which I shall reproduce, the author turns to the nature of the planets and finishes with the moon at the bottom of fol. 20v, where the text appears to break off. From fol. 21r on we have a different handwriting and style of page, more of the paper than before being covered with writing. In Corpus Christi 125, 14th century, fols. 39r-41v, the text continues considerably beyond the point where fol. 20v of All Souls 81 breaks off, but the writing is very abbreviated and fol. 40 torn and faded. In none of the other manuscripts listed by Mrs. SINGER does the text occupy more than a few folios or have the Explicit proposed for All Souls 81. Mrs. SINGER and COXE give as the closing words of our treatise in the All Souls Ms., « Explicit Ycocedron (Ycocedrom?) philosophie, » but I should incline to regard this as the end of another treatise. At any rate it does not occur either at fol. 52v or fol 17, as Mrs. SINGER and COXE might respectively seem to imply in their notices of the Ms., but at fol. 18r, immediately preceding our treatise which begins on the reverse of that leaf. Finally, COXE gives a reference to BANDINI, *Catalogus codicum Laurent. Latt.*, tom. II. col. 33, but this citation does not have any connection with our treatise and must be erroneous.

(2) Library of the Dukes of Burgundy 4275 : cited in my *History of Magic* etc., II, 218, note 4.

and seven *magisteria*. It is with the last that we shall concern ourselves here. These «masteries» or mysteries are not, as one might guess, methods or processes of obtaining the philosopher's stone and transmuting metals into gold, but seven different kinds of salts. Their constitution is briefly stated and they are thereby distinguished from or related to one another. The passage therefore seems worth reproducing in print, as indicative of the state of chemical knowledge at that time.

(All Souls 81, fol. 19r)

« Sal armonicus qui fit de sanguine hominis et sale communis ut postea plenius declarabimus.

Sal gemma qui est coloris cristallini et fit ex sale alkali et sale communi et aqua maris vel salsa ut dicemus inferius.

Sal nitrum qui fit ex sale gemma et sale alkali.

Sal calcis qui fit ex sale nigro et sale alembroc et fit de 7 herbarum succis.

Sal communis qui fit de aqua maris sive salsa.

Sal alkali qui fit ex sale vitro bene trito et isto sale utuntur vitriarii quia per ipsum operantur in fusione vitri.

Sal alembroc qui fit ut diximus ex 7 herbarum succis.

Et hoc est quod dicitur magisterium omnium magisteriorum nam hoc mirabile facit scilicet de mercurio lunam (fol. 19v) et solem purissimum. De quibus omnibus tractabimus in suis locis cum opus fuerit. »

Columbia University LYNN THORNDIKE.

The knot in Hebrew literature, or from the knot to the alphabet

I. Introductory.

1. The Natural and the Mechanical Memory. — 2. Writing, the Memory-Machine. — 3. Knots, the Primitive Memory-Tools.

II. Knots in Magic and Superstition.

4. Magic Knots. — 5. The Magic Knot in Hebrew Literature. — 6. The Cameo. — 7. The vow. Binding and Loosing. — 8. The Magic Knot in the Quiân. — 9. The One who Loosens the Knot.

III. Historical and Mnemonic Knots.

10. The Quipu. — 11. Two aspects of the Quipu. — 12. The Phylacteries (*Tephillin*). — 13. The Fringes (*Ṣiṣith*). — 14. More Evidence for Mnemonic Knots in the Bible. — 15. The Rôle of the Quipu in the Organization of Revolts.

IV. Mathematical Knots.

16. Knots in Counting. — 17. The Knot-Abacus. — 18. Arabic, Roman, and Greek Traces of the Knot-Abacus. Articuli. — 19. Knotted Cords as Registers and Accounts. — 20. The Publican's Knot in Palestine. —

V. Knot-Letters or Knot-Numerals.

21. Knot-Receipts. — 22. The Ghobar-Numerals, or Apices, are called « Roman Knots ». — 23. Knot-Letters in the Phylacteries. — 24. Egyptian and Chinese Knot-Letters. — 25. Conclusion. From the Knot to the Alphabet.

Literature.

The main works dealing with this subject and extensively used by the author of this paper, are :

1) J. G. Frazer, *The Golden Bough*, III, *Taboo*, London, 1911, pp. 293-317.

2) Walter J. Dilling, Article on Knots in Hasting's *Encyclopaedia of Religion and Ethics*, vol. VII, 1915, pp. 747-751.

3) L. Leland Locke, *The Ancient Quipu*, or *Peruvian Knot Record*, New York, The American Museum of Natural History, 1923. (1)

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(1) Reviewed in *Isis*, VI, 219. Additional literature on the subject is : 1. Nordenskiöld Erland, *The Secret of the Peruvian Quipus*, 1925. Reviewed, *Isis*, VIII, 638. (The grave quipus are calendars indicating the number of days. Astronomical and also magic quipus.) 2. Nordenskiöld, *Calculations with years and months in the Peruvian Quipus*, 1925. (The astronomical knowledge of the Peruvian Indians is preserved in the quipus.). 3. Locke, « *Supplementary Notes on the Quipus*, in the *Anthropological Papers*, published by the American Museum of Natural History, 1928, vol. XXX, Part II. (*Isis*, XI, 548)

I. Introductory.

1. *The Natural and the Mechanical Memory.* — The natural memory, as Henri Bergson (1a) points out, « is not a faculty of putting away recollections in a drawer, or of inscribing them in a register. There is no register, no drawer; there is not even, properly speaking, a faculty, for a faculty works intermittently, when it will, or when it can, whilst the piling up of the past upon the past goes on without relaxation. In reality, the past is preserved by itself, automatically. In its entirety, probably, it follows us at every instant; all that we have felt, thought, and willed from our earliest infancy is there, leaning over the present which is about to join it, pressing against the portals of consciousness that would fain leave it outside. The cerebral mechanism is arranged just so as to drive back into the unconscious almost the whole of this past, and to admit beyond the threshold only that which can cast light on the present situation or further the action now being prepared — in short, only that which can give *useful* work. At the most, a few superfluous collections may succeed in smuggling themselves through the half-open door. »

Writing is a mechanical memory. It produces *registers* and *drawers*. It creates a faculty that will work intermittently, when it will or when it can. Natural memory maintains itself by continuous repetitions, thus counteracting the natural process of the cerebral mechanism, renewing daily the battle between the unconscious and the consciousness. In this battle it supports the weaker party, the unconscious that is pressing against the portals of the consciousness. From time to time it throws open those portals, lets the past recollections march in, parade there for a short while, in order to be driven out again by the victorious consciousness, asserting its rights and privileges. Mechanical memory works as a peacemaker. It supports the natural process of the cerebral mechanism, but it recompensates the unconscious by building for it a special house to live in. Those superfluous recollections, not useful at the present, and driven out by the practical consciousness, are hospitably taken in, they are written down, carefully preserved, and live on to form this gigantic struc-

(1a) *Creative Evolution*, p. 4.

ture and magnific edifice that we call literature, history, and science.

2. *Writing, the Memory-Machine.* — The art of writing forms the foundation of our civilization. By the invention of writing, man conquered space and time, he created not only an artificial speech, but also an artificial memory, impersonal, common to the human race, and much more reliable, more exact, and more enduring, than the natural memory. Writing is a means to perpetuate our thoughts and traditions, to transmit them to the remotest places and to latest posterity. Writing is a mechanical device to substitute and improve human memory, it is the memory-machine.

3. *Knots, the Primitive Memory-Tools.* — The first groping attempts in the invention of primitive memory-tools, serving to bind the flying past, to tie up the fleeting memories, escaping from the consciousness into the unconscious, are the knots that still live with us in the knot tied in a handkerchief to support a weak memory. Even as those ancient idols, destined to represent the abstract deity by tangible and visible symbols, so, too, the knotted cords were the tangible and visible signs and symbols recording the abstract numbers, the facts, poems, and laws of the past, the historical events and traditions. Their purpose was « to call up a recollection, to give it a body, to render it active and thereby actual. » (1b) Knotted cords were the first memory-drawers and registers, they were the primitive tools out of which developed the powerful memory-machine of our modern writing, they were the primitive memory-huts and tents out of which grew up that gigantic structure that we call literature, history, and science.

II. Knots in Magic and Superstition.

4. *Magic Knots.* — Yet there is still a more primitive stage in the history of the knots, and that is the phase of magic and superstition. As in the experimental sciences (2), so also in the arts and crafts the first beginnings seem always to be connected

(1b) See H. Bergson, *Matter and Memory*, pp. 71, 72.

(2) See the writer's article « On the Origin of the Gnomon », soon to appear in the *Bibliotheca Mathematica*.

with some kind of magic. « The (3) symbolic use of the knot is of great antiquity and of world-wide distribution. Knots have, among practically all primitive races, a special mystical significance, namely, that as amulets they possess the power of binding or impeding specific conditions... The act of tying a knot implies something « bound », and hence the action becomes a spell towards hindering or impeding the actions of other persons or things. Similarly, the act of loosing a knot implies the removal of the impediment caused by the knot, and from this belief are derived the various customs of unloosing knots etc., at periods, when undesirable hindrance of any event is feared. Such customs are instances of imitative or homeopathic magic, and the same principle underlies cases in which the tying of knots has a beneficent influence ».

5. *The Magic Knot in Hebrew Literature.* — In Hebrew Literature the « charmer » or « enchanter » (4) is also called *ḥober ḥaber* (5) which means literally « a man who ties (magic) knots. » (6) Babylonia is a land characterized by « the multitude of its sorceries and the great abundance of its enchantments », (7) literally : « by the great abundance of its knots », and from other sources (8) we learn indeed that « knots were largely employed by the Assyrians in their spells for removing illness... and to prevent the spirits of the dead from annoying the living ». (8a)

6. *The Cameo.* — In postbiblical Aramaic literature the amulet is called *qami'a*, meaning originally a knot and then something suspended or attached by a knot. (9) This word might perhaps

(3) See DILLING in HASTING's *Encyclopaedia of Religion and Ethics*, VII, (1905)' p. 747, and cf. also J. G. FRAZER, *The Golden Bough*, III, *Taboo*, London 1911, pp. 295 sqq.

(4) Here and in the following the words used in the revised English version of the Bible are quoted.

(5) Deuter., 18, 11; Psalms, 58, 6.

(6) See the Hebrew Dictionary of GESENIUS, New York, 1907, p. 288. Cf. also the English « spellbound ».

(7) Isaiah, 47, 9, 12.

(8) DILLINGS, *loc. cit.*, p. 750.

(8a) Perhaps, this was also the magic significance of those Peruvian quipus that were deposited in the graves; cf. ERLAND NORDENSKIÖLD, *The Secret of the Peruvian Quipus*, 1925, pp. 9 and 36.

(9) Cf. the dictionaries of LEVY (IV, p. 326) and JASTROW (p. 1385) and especially the passage in *Tosefta Dammai*, II, 17; *Babli Bekhorot* 30b, where *qoma'ath* means « she tied ».

be the origin of the English « cameo ». The great Oxford English dictionary (10) says that « cameo » is of unknown derivation. By some other authorities (11) it has been explained as having its derivation from the Arabic « camea » an amulet. The writer did not find the word « camea » with this significance in the Arabic dictionaries. (12) In all probability, the writer of the Encyclopaedia Britannica thought of the Aramaic « camea ». (13)

7. *The Vow. Binding and Loosing.* — In a similar sense the Bible (14) speaks of a person that binds herself by an oath or a vow in the words : « If a man vow a vow unto the Lord, or swear an oath *to bind his soul with a bond* ». Literally, however, the last words should be translated : « to tie a knot against himself ». (15) Usually the vow was made in an ascetic and prohibitive sense, namely, that the person would refrain from some of the pleasures of life, as from certain kinds of food, or from the social intercourse with some people. Originally such prohibitions and hindrances were effected by the tying of a knot. Later on, the spoken word of the vow sufficed. But the language still preserved the idea of the knot, that was substituted by the spoken word. This will also explain the general usage of the words « to bind and to loose » for to prohibit and to allow, and the Hebrew terms *asûr* and *muttar* « bound », and « loosened », for « prohibited » and « allowed ». The magic was removed and the spell cured by untying the knot and loosening the bond. There is an incantation against the female demon *Lilit* (16) « Loosen (thy knots), loosen (thy knots), neither enter, nor take out ».

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(10) Ed. MURRAY.

(11) *Encyclopaedia Britannica*, 11th ed., V, p. 104. In the 14th ed. this etymology is dropped.

(12) LANE, STEINGASS and WAHRMUND.

(13) In *Mishna Shabbat*, VI, 9 (f. 66b) we find perhaps the Hebrew equivalent for *qami'a* in *qesharim*. « The children may go out on a Sabbath with their knots (amulets) ». ABAYYI, in the *Gemara ib.*, related, in the name of his mother, that three such knots stop the disease, five knots cure it and seven knots are good even against witchcraft. The *Gemara, ib.*, explains the *qesharim* as the garlands of *Puah* (Rubia Tinctorum), or as an attached shoelace. On knots and rings as amulets see also FRAZER, *loco cit.*, p. 314 seq.

(14) Numbers, chap. 30.

(15) *Le'sor 'isar 'al nafshō.*

(16) Cf. *Siddūr Derekh ha Ḥayyim*, p. 170 « *Shārē, shārē, lā teōl welā tapēq.*

8. *Magic Knots in the Qurân.* — In the Qurân (17), MUHAMMAD takes refuge against the women that blow or utter magical words upon the knots. In relation to this Sura the commentators (18) relate the following story: LUBAID, a Jew, with the assistance of his daughters, bewitched MUHAMMAD by tying eleven knots on a cord which they hid in a well. Thereupon MUHAMMAD became weak, refused the food and neglected his wives. The two Suras, 113 and 114, were then revealed to him, and Gabriel acquainted him with the use he was to make of them, and of the place, where the cord was hidden. The prophet sent ALI to fetch the cord, repeated the two Suras over it, and at every verse, (19) a knot was loosed, till he was entirely freed from the charm.

The detail, mentioned above, that MUHAMMAD neglected his wives, reminds of the widespread mediaeval superstition that a person could prevent the performance of the marriage act by tying a knot. The tying of such knots was known in Germany as « *Nestel Knüpfen* » and in France as « *nouer l'aiguillette* ». (20) In mediaeval Hebrew, too, (21) the word *asar* occurs in the meaning « to tie somebody by a knot charm, so that he cannot cohabitate with his wife. » (22)

9. *The One who Loosens the Knot.* — ALEXANDER THE GREAT used a simpler method than MUHAMMAD. He cut the Gordian knot in two with his sword, and became the king of Asia in fulfillment of the oracle that declared that whoever should unloose the knot would rule over all Asia. The signification of this legend is perhaps that the powerful ALEXANDER accomplished with his sword more than the magicians with their incantations and sorceries. (23) DANIEL, one of the wisest men of antiquity, (24) is characterized (25) as a man who « interprets dreams, declares

(17) Sura 113.

(18) See WHERRY, *Commentary on the Koran*, IV, London 1886, p. 296 sq. Cf. also MUIR, Life of *Mahommet*, IV, London, 1861, p. 80; FRAZER, *The Golden Bough, III, Taboo*, p. 302; BROWNE, *A Literary History of Persia*, I, p. 366, note 2.

(19) The two Suras consist of eleven verses.

(20) See DILLING's article, *loc. cit.*, p. 748.

(21) See BEN JEHUDA, *Thesaurus*, I, p. 334.

(22) Cf. also FRAZER, *loc. cit.*, p. 299 seq.

(23) Cf. FRAZER, *loc. cit.*, p. 316 sq.

(24) See Ezekiel, 14, 14.

(25) Daniel, 5, 12, 16.

riddles and *looses the knots* » (26). On the other hand an old Arabian poet boasts he is the man « whose knot none looses » (27).

III. Historical and Mnemonic Knots.

10. *The Quipu.* — Very early mankind started to employ the knots for more useful purposes than for magic and spells. The use of knots in cord for the purpose of reckoning and recording numbers seems to have been as universal as the figures of the cat's cradle in the practices of primitive people. The most remarkable development of knot records, not only for numbers but also for historical tradition and governmental accounts, took place among the Inca of Peru. Hence the name *quipu* which means knot in the Peruvian language. (28) Here, in Peru, is found the anomaly of a people with a highly complex civilization, particularly in governmental machinery, with a wealth of tradition, with a peculiarly rich and expressive language, but with no system of writing except the quipus or knot records.

Of the forty-nine specimens of ancient quipu located, (28a) the American Museum of Natural History possesses forty-two. The quipu consisted of a main cord held horizontally, to which were fastened at given distances other cords of various colors and lengths, hanging vertically. These vertical cords were knotted in different ways, all these knots of different sizes and shapes and the various lengths and colors of the cords served by means of an arranged code to convey certain numbers, words, phrases, and ideas. (29)

« In the empire of the Inca a class of learned men understood by the help of the colors the interpretation of the quipus as we

(26) The revised English version has « dissolving of doubts ».

(27) Quoted by Nicholson, *A Literary History of the Arabs*, p. 98, line 3 from the bottom.

(28) See L. Leland Locke, *Mathematics*, in *Outline of Knowledge*, VIII, pp. 447-448; *The Ancient Quipu*, p. 9, 40. The latter book is the best account of the history of the quipu, and the following lines on the general nature of the quipu are mostly based upon the information and quotations given by Locke in this book.

(28a) There are now probably about 156 specimens; see Nordenskiöld, *The Secret of the Peruvian Quipus*. This was called to my attention by Dr. Sarton.

(29) Locke, *ib.*, pp. 9, 3, 13 sq, 34. 56; Edward Clodd, *The Story of the Alphabet*, p. 37.

understand the contents of books at the present day... Officers under the titles of quipucamayus, of keepers of the quipus, were required to furnish the government with information on various important matters. Annalists and other functionaries of a higher character, were intrusted with the history of the empire, which was communicated by oral tradition using the quipus to arrange the incidents with method and refresh the memory ». (30)

11. *Two Aspects of the Quipu.* — Thus the quipus were used for two purposes : First and primarily for recording numbers. The extant examples indicate without question that they are numerical in nature. It is, however, very probable, that they were also used as memoria technica in memorizing historical traditions, poems, lists of kings, etc. This does not mean that the poems and stories were *written* by quipus, only that the quipus served as symbols and memoria technica. It is stated that the quipu must be accompanied by an oral commentary, indicating the nature of the contents. When mentioned in connection with historical data, the phrasing, « quipus and memorials », « quipus and histories », or « quipus and traditions », is of frequent occurrence. (31)

Sir CLEMENTS R. MARKHAM (32) says : « The system of records by the use of quipus, or knots, was primarily a method of numeration and of keeping accounts. But the question of the extent to which historical events could be recorded by this system of knots is a difficult one. We have direct assertions... that not only narratives, but songs, were preserved by means of the quipus... It may reasonably be assumed that with some help from oral commentary, codes of laws, historical events, and even poems were preserved in the quipus... Still it must have been rather a system of mnemonics than of complete record... There must have been interpreters of the quipus, those who, with the knowledge derived from other sources, could use the knots as reminders and suggesters... as a sort of aid to memory, or a memoria technica ».

On the other hand there are some scholars who regard the quipu

(30) Similarly, the Hebrew root *paqad* means originally « to remember », then « to count », then in *paqid* « to be an officer, commissioner ». *Paqid* means originally, like *quipucamayu*, to be a keeper of the records, a recorder, accountant; the same is the case with the word *mazkir*.

(31) LOCKE, *ib.*, pp. 31-32.

(32) Quoted by LOCKE, *ib.*, pp. 55 seq.

as « simply an instrument for recording numbers ». They characterize the tales of the chroniclers of the period of the Conquest of America concerning quipus recording history, folklore, and poems, as « exaggerated notions », or « bizarre stuff ». (33)

12. *The Phylacteries (Tephillin)*. — It is the writer's purpose now to prove that the Bible indeed furnishes us some very striking parallels to quipus being used as memoria technica for the purpose of recording traditions, codes of laws, and historical events.

The Jewish phylacteries or frontlets are small leather boxes in which are strips of parchment with passages from Hebrew Scripture. They are fixed on the forehead and on the left hand by knots, and the evidence from the Bible text is that the knot played the main rôle in it. The text reads : (34) « And these words which I command thee this day, shall be upon thine heart : and thou shalt teach them diligently unto thy children and shalt talk of them when thou sittest in thine house, and when thou walkest by the way, and when thou liest down, and when thou risest up. And thou shalt ***bind*** them for a ***sign*** upon thine hand, and they shall be for frontlets between thine eyes. And thou shalt write them upon the door posts of thy house, and upon thy gates ». The lawgiver is very anxious that his laws shall not be forgotten and neglected in the course of the time. So he enjoins his people to preserve them well in their hearts and to hand them over to their children by oral tradition. He orders them to repeat and memorize these commandments, to strengthen their memory by knots and mnemonic signs, tied around their hands and heads and to write them down.

Thus the three phases in the preservation of old traditions and laws are here represented : 1) Memory pure and simple; repetition and transmission by oral tradition to the children; 2) Knots and mnemonic signs, the precursors of writing, and 3) Writing. In a similar way the Proverbs (35) enjoin the preservation of the law with the words : « My son forget not my law; but let thine heart keep my commandments... ***Bind*** them about thy neck; write them upon the table of thine heart »... « My son, keep my words, (in thy memory)... ***Bind*** them upon thy

(33) Cf. the Foreword of CHARLES W. MEAD to LOCKE's book.
(34) Deut. 6, 6-8.
(35) 3, 1, 3; 7, 1-3.

fingers; write them upon the table of thine heart ». In these verses, too, to bind the commandments around the neck and the fingers, means to tie mnemonic knots around the neck and the fingers. These probverbs, too, mention memory, knots and writing as means of preservation.

That the knot was the most, or very important part in the phylacteries appears also from the Talmud. So the legend has it that God showed Moses the knot of the phylacteries of the head. This knot had the shape of the letter *daleth*, while the knot on the hand must imitate the letter *yod*. The earlier Tannaim had to resort to fanciful interpretations of the texts in order to find biblical support for the custom of inscribing the four selections in the phylacteries. (36)

The phylacteries resembled amulets (*qemi'ōt*) ; they are, in fact, often mentioned side by side with *qemi'ōt*, and were liable to be mistaken one for the other. (37) They have been connected with magic, as the name of phylacteries (38) primarily indicates. The fact, however, is that it is only the exterior form of the knots that they have in common with amulets. By nature and purpose, they do not belong to the class of the magic knots but to the mnemonic and memorial knots, as it is clearly stated in the text of the Bible. The phylacteries serve as memorials not only for the laws but also for the great historical event of the exodus from Egypt. The meaning of the verses : (39) « And it shall be a sign unto thee upon thine hand, and for a memorial between thine eyes, that the Lord's law may be in thy mouth : for with a strong hand hath the Lord brought thee out of Egypt »; « And it shall be for a token upon thine hand, and for frontlets between thine eyes : for by strength of hand the Lord brought us forth out of Egypt », can only be that the memory of the exodus from Egypt shall be preserved by a symbol upon the hand and by a memorial between the eyes.

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(36) See *Jewish Encyclopaedia*, X, pp. 21, 20, and 22; *Babli Menaḥot*, 34*b*, 35*b*; *Rashi*, *ib.*, s.v. *qashar*; Zeb. 37b; *Sanh.* 4b; *Rashi* and *Tosafot ad loc.* For illustrations of the knots, see *Jewish Encyclopaedia*, X, pp. 22, 24; SURENHUSIUS, *Mishnah*, I, Amsterdam, 1698, before p. 9.

(37) *Jewish Encyclopaedia*, X, p. 27; cf. § 6 above.

(38) This name first occurs in the New Testament, whence it has passed into the languages of Europe; see *Jewish Encyclopaedia*, X, pp. 26, 27.

(39) Exodus, 13, 9, 16.

13. *The Fringes (Ṣiṣith).* — Still stronger evidence for the existence of the recording quipu among the ancient Hebrews is to be found in the law of « fringes » (ṣiṣith). According to the school of SHAMMAI, the fringes consisted of four threads of white wool and four threads of blue, but according to the school of HILLEL they consisted of two threads of each. Those threads are fastened to the four corners of the garment (*Ṭallith*, or *Arba' kanphoth*), twisted to a cord in which five double knots are tied—the knots are to have different distances from each other—and tapering off in the form of loose fringes (40). They are called in Hebrew once (41) *ṣiṣith*, meaning « fringes », « tassels », and also « locks », (42) and another time (43) *gedilim*. In Hebrew, Aramaic and Syriac *gedila* means « thread, cord, rope » and is derived from *gadal*, Arabic *jadal* « to twist a cord or rope ». The Babylonian *gidlu* (44) means « a cord on which onions are strung, a string of onions ». The knotted cord resembles the string of onions, it is therefore quite probable that *gedilim* are to be translated, in accordance with the traditional practice and observance, « knotted cords ». According to the *Sifre* (45), the oldest Midrashic commentary to the Bible, the *gedilim* are the twisted, knotted threads attached to the border of the garment, and the *ṣiṣith* are the loose fringes in which they end.

Now, the purpose and task of these fringes is clearly stated in the Bible, as follows : (46) « Speak unto the children of Isreal and bid them that they make them fringes in the borders (or corners) of their garments throughout their generations, and that they put upon the fringe of each border a cord of blue : and it shall be unto you for a fringe, *that you may look upon it and remember all the commandments of the Lord*, and do them. » There can be no doubt that the fringes, with the threads of white and blue

(40) See *Jewish Encyclopaedia*, V, p. 521 sq., and concerning the knots cf. *Babli Menaḥoth* 39a; *Rashi*, ib., under *min kanaf*; *Tosafot* under *lo yifḥot*; and *Oṣar Israel*, IX, p. 38.

(41) Numbers, 15, 38.

(42) Ezekiel, 8, 3 « and he took me by a lock of mine head ».

(43) Deuter. 22, 12.

(44) See DELITZSCH-HAUPT, *Beiträge zur Assyriologie und Semit. Sprachwissenschaft*, I, p. 511.

(45) Numbers § 115, ed. FRIEDMAN, f. 34a :

(46) Numbers 15, 38-39.

wool twisted to a cord and having five double knots at different distances, of which the outspoken purpose is that people may look upon them and remember the commandments, represent the vestigial remnant of the old Hebrew quipu, and that the ancient Hebrews were familiar with some form of quipu, that served to record the laws, traditions, and historical events. (47)

It suffices to compare the following descriptions of the Peruvian quipu given by the oldest and best authorities on Peruvian antiquities. PEDRO DE CIERA DE LEON, born in Seville in 1519, at the early age of fourteen set out to seek his fortune in the New World and is regarded as one of the most important authorities on Inca history and civilization. He relates : (48) « The Peruvian quipus were of *twisted wool*, (49) and consisted of a large cord, *with finer threads fastened to it by knots. These fringes contained the contents of the quipu*, which were denoted either by single knots or by artificial intertwinings... *The different colours of the threads had different meanings*, and not only was the colour and mode of intertwining of the knots to be considered, in reading a quipu, but even the mode of twisting the thread, and *the distance of knots from each other*, and from the main cord. The registers of tribute; the enrolment of tribes... lists of arms and troops; inventories of the contents of storehouses; all these were the primary uses of the quipus. But they were also made available for recording the most striking events and thus supplied the place of chronicles. »

GARCILASSO DE LA VEGA, el Inca, was born at the Inca capital, Cuzco, in 1539. He was the son of a Spanish cavalier of the same name, and his mother was the Inca princess CHIMA OCLLO. The young Inca spent the first twenty years of his life among his mothers' people, imbibing their culture and traditions. GARCILASSO informs us : (50) « The Quipucamayus were referred to by the Curacas, and chiefs of the provinces to tell the historical events relating to their ancestors which they desired to know, or any

(47) See also the article on knots by JACOBS in the *Jewish Encyclopaedia*, VII, p. 525. Mr. SEIBEL of Newark, my esteemed friend and teacher, called my attention to the fact that the *Bêûr ad loc.*, written by HERZ HOMBERG (1749-1841), already refers to the Peruvian knots as an explanation of the *ṣiṣith*.

(48) LOCKE, *The Ancient Quipu*, p. 33, and note 1, *ib.*

(49) This and the following passages are underlined by the writer.

(50) See LOCKE, *loc. cit.*, pp. 39, 41.

other notable circumstance which had happened in their provinces. For these officers, like scribes and historians kept, the registers or quipus handed down by their predecessors, and were bound by their office to study them constantly by means of the signs and indications in the knots, so as to preserve the memory of the traditions respecting famous past events. It was their duty to narrate these events when called upon to do so; and for this service they were exempted from other tribute. Thus the meaning of the knots was never allowed to slip from their heads. By the same means they gave an account of the laws, ordinances, rites, and ceremonies. From the color of the thread or the number in the knot they could tell the law that prohibited such and such an offence, and the punishment to be inflicted on the transgressor of it. They could set forth the sacrifices and ceremonies that should be performed on such and such festivals; and could declare the rule or ordinance in favor of the widows or the poor : and to give an account in short, of all things preserved by tradition in their memories. Thus each thread and knot brought to the mind that which it was arranged that it should suggest... The Indians remembered, by means of the knots, the things which their fathers and grandfathers had taught them by tradition, which things they received with great attention and veneration as sacred matters relating to their idolatry or to the laws of their Incas; and they succeeded in preserving them in their memories, for want of a knowledge of writing ».

GARCILASSO's knowledge of the quipu has been called in question. But his detailed report bears the stamp of the truth on its face, and is corroborated by several other authorities on Inca civilization, and, as we now see, is even supported by a somewhat similar institution of the Bible.

14. *More Evidence for Mnemonic Knots in the Bible.* — This theory of the acquaintance of the ancient Hebrews with the quipu will help us to a better understanding of several passages in the Bible. ISAIAH says : (51) « Bind thou up the testimony, seal the law among my disciples ». The meaning is : Preserve testimony and law by mnemonic knots and seals (symbols). HOSEA complains : (52) « The iniquity of EPHRAIM is bound up : his sin

(51) 8, 16. On the identity of seals and knots see hereafter note 89.
(52) 13, 12.

is laid up in store ». He wants to say : The sin of EPHRAIM will never be forgotten, it is recorded by a quipu. In the same sense JOB cries : (53) « My transgression is sealed up in a bag, (54) and thou fastenest up mine iniquity ». The *ṣeror* is not a bag, but the recording knot, that preserves the sins, traditions, and laws.

In the two verses Isaiah 28, 10, 13, people are described as mocking at the word of the Lord. They deride and belittle it as *ṣaw laṣaw, ṣaw laṣaw, qaw laqaw, qaw laqaw*, i.e. : « Precept upon precept, precept upon precept, cord upon cord, cord upon cord. » The commentaries make futile efforts to find any sense in the connection between the precepts and the cords. According to the theory propounded in this paper, the cord is the quipu that preserves the precept. The scornful drunkards make fun of those teachers who pile up law upon law, and then of course have to pile up quipu upon quipu in order not to forget them. The septuagint reads : δλῦψις ἐπὶ δλῦψιν, ἐλπὶς ἐπ' ἐλπίδι, i.e. they had in the Hebrew text *ṣar laṣar, ṣar laṣar etc.* and explained it « distress upon distress, hope upon hope ». But in accepting the reading of the septuagint, the right translation would be : « knot upon knot, knot upon knot, cord upon cord, cord upon cord ». To those mockers the word of the Lord is nothing else than knots and cords, knots and cords, meaningless and valueless.

15. *The Rôle of the Quipu in the Organization of a Revolt.* — Many passages in the Bible tell of conspiracy, treason and rebellion. But while reading it in the modern translations, and even in the original Hebrew, we do not realize that the phrase *qashar'al* used for conspiracy, means verbally, « to make a knot against somebody ». For instance : (55) « ZIMRI hath conspired », literally : « ZIMRI hath made a knot »; « and his treason that he wrought », literally : « and his knot that he tied ». « AMOS hath conspired against thee », (56) verbally : « hath made a knot against thee ».

What was the nature and meaning of these knots ? There is little probability that they were magic knots originally meant to injure the person against whom the rebellion was initiated.

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(53) 14, 17.

(54) Hebrew : *seror*, is literally « a knot, bundle ».

(55) I Kings, 16, 16, 20; also II Kings, 15, 15.

(56) Amos, 7, 10; cf. also I Sam. 22, 8, 13; II. Sam. 15, 31; I Kings, 15, 27; 16, 9; II Kings, 10, 9; 21, 23, 24; 15, 10; 25, 30; 12, 21; 14, 19; 11, 14: etc.

Perhaps, it was a ceremony to confirm the solemn covenant of the rebels. This is the nature of a similar primitive custom related by FRAZER : (57) « In the Wachagu tribe of the same region (East Africa), when two districts have resolved to form a solemn league and covenant of peace, the following ceremony is observed. The warriors of the two districts assemble. Then a long rope is stretched around the assembly and its free ends are knotted together on one side, so that the whole body of warriors from both sides is enclosed within the rope ». The best explanation, however, in the writer's opinion, is that these knots were means of communication serving to organize the rebellion. As such the knots were also used by the Indians. « Among (58) some of the tribes of the southern United States, if a definite time was set for a certain event, count was kept by untying one knot each day : by this means the Pueblo Indians were enabled to make simultaneous revolt against the Spaniards in 1680. » Another great revolt against the Spaniards was organized in 1792. « As (59) was found out later the revolt had been organized by means of messengers, carrying a piece of wood in which were enclosed threads, the ends of which formed red, black, blue, or white fringes. The black thread had four knots, which signified that the messenger had started... four days after full moon. The white thread had ten knots, which signified that the revolt would break out ten days after the arrival of the messenger. The person to whom the keeper was sent had in his turn to make a knot in the red thread if he agreed to join the confederates; in the red and blue threads, on the contrary, if he refused ».

IV. MATHEMATICAL KNOTS.

16. *Knots in Counting.* — As already mentioned above, (60) the knots were primarily and mainly used in recording numbers and accounts, and as we shall presently see, they were particularly employed in facilitating the primitive counting. « In Formosa the aborigines ignored writing. They have not any means of

(57) *Folk-Lore in the Old Testament*, I, pp. 395-396.
(58) DILLING, in HASTING'S *Encyclopaedia of Religion and Ethics*. VII, p. 748.
(59) LOCKE, *loc. cit.*, p. 55.
(60) See page 196, § 11.

keeping time, and when they have made an appointment for any date, their only means of keeping a check on the days as they pass is by means of a tally of stones or grass, one stone or one knot in the grass representing a day. (61) Similarly, in some other places, « to mark the time for the festival, a string with a number of knots, equal to the number of days, that will intervene is sent to each; from the strings, to avert mistakes, one knot is daily cut,... when one knot remains the guests assemble ». Or, as some one else reports; « The king delivered to him a piece of cord, on which he had tied as many knots as there would be days before our people proposed to sail. » (62) HERODOTUS, (IV, 98), tells us that when DARIUS bade the Ionians remain to guard the floating bridge which spanned the Ister, he tied sixty knots in a thong, saying : « Men of Ionia, do keep this thong and do as I shall say; so soon as you shall have seen me go forward against the Scythians, from that time begin and untie a knot each day : and if within this time I am not here, and ye find that the days marked by the knots have passed by, then sail away to your own lands. » (63) Finally, we hear that in Southern India at the ceremonial for settling the preliminaries of a Khond marriage, a knotted string is put into the hands of...« the searchers for the bride », and a similar string is kept by the girl's people. The reckoning of the date of the betrothal ceremony is kept by undoing a knot in the string every morning. (64)

This gives us a clue to the explanation of the Prophet JEREMIAH when he says : (65) « Can a maid forget her ornaments, or a bride her attire ? yet my people have forgotten me days without number ». The Hebrew word for « attire », *qishshurim*, denotes literally « knots » or « knotted strings ». (66) These were in all probability the knotted strings by which the Hebrew bride counted the days

(61) See LOCKE, *loc. cit.*, p. 63; cf. also DILLING, *loc. cit.*, p. 748, quoted in § 15, and NORDENSKIÖLD E., *Calculations with years and months in the Peruvian quipus*, 1925, p. 11.

(62) LOCKE, *ib.*, p. 62.

(63) Quoted by EDWARD CLODD, *The Story of the Alphabet*, p. 37; see also SMITH, *History of Mathematics*, II, p. 195.

(64) LOCKE, *ib.*, p. 62; cf. also further note 73c.

(65) Jeremiah, 2, 32.

(66) The form *qishshurim* is also used for the knotted cords of the tax-collector; see *Tosefta Dammai*, II, 17, ed. ZUCKERMANDEL, p. 48, note 20; ed. SCHWARZ, Wilna 1890, p. 104; and hereafter, note 85.

till her wedding. The bride looking forward to her wedding day would certainly not forget her knotted strings and not suffer one day to pass by without untying one knot. Yet the Israelites, the Lord's bride, have forgotten their Lord *days without number*. They were like the faithless bride, that does not care for the approach of the wedding day, that forgets to untie the knots and thus lets *several days pass by without number*.

17. *The Knot-Abacus*. — A further step in the development of the mathematical quipu was done by having the knots, or the different pending ropes attached to the main cord, mark the place value of the numbers. In figure 1 LOCKE (67) shows the forms of the knots and the modes of tying which exist in the specimens studied. « The single or overhand knot indicates 1 if it is in the row farthest from the main cord, 10 if it occurs in the next nearer row, 100 in the next row, etc. Not more than nine single knots are placed in one group, the number system being strictly decimal. The figure eight (8) knot occurs frequently ». « The ones, tens, and hundreds are arranged in rows across the quipu, as a good accountant arranges them in columns ». (68) Another method was to indicate the place value by the different shape and size of the knots. So a single knot meant ten, a double knot one hundred, a triple knot one thousand; two single knots meant twenty, two double knots two hundred, etc. (69) The Zuñi Indians developed a similar system of knot numerals which involved at the same time the subtractive principle. (70) A medium knot indicated five, and this with a small knot before it indicated 5—1, whereas if the small knot came after the medium one the number was 5+1. Similarly, a large knot indicated ten, and a small knot was used either before or after it so as to indicate 9 or 11 respectively.

The quipu would thus represent the primitive form of a knot-abacus with knot numerals, the decimal system and the place value, in which the pendent ropes served as columns for marking the place value. (71) It is generally assumed that the knot-abacus

(67) *Ib.*, p. 13 and 15.
(68) *Ib.*, p. 17; see also pp. 34, 40.
(69) *Ib.*, p. 57.
(70) SMITH, *History of Mathematics*, II, p. 59.
(71) See SMITH, *loc. cit.*, II, pp. 195, 45; CANTOR, *Geschichte der Mathematik*. I, 4th edition, p. 88.

was not adapted to purposes of calculation. (72) GARCILASSO DE LA VEGA, however, relates that « they added up and multiplied by these knots ». (73)

In this connection, the hypothesis might well be ventured that the very term *abacus*, originally, denoted nothing else than *the knotted cord*. Till now it was generally assumed that it means the dust board and that it goes back to the Hebrew word *abaq*, dust. (73a) Now the Hebrew-Aramaic word *abaq* has two roots. The one meaning « dust, powder », or « to cover with dust », and the other signifying « a loop, knot », or « to make a loop or knot, to twist, twine, to be attached to, cling to » (73b).

The probability, therefore, in the writer's opinion, is that the term abacus does not belong to the first root, meaning dust, but to the second root, meaning knot, and that it was applied, originally, to the knotted cord. (73c)

18. *Arabic, Roman, and Greek Traces of the Knot-Abacus. Articuli.* — Traces of this old knot-abacus are still to be found in some of the ancient languages. So in Arabic the tens and hundreds are called knots (*'uqûd*). ALKHOWARIZMI (c. 825) (74) says that the numbers consist of units (*aḥâd*), knots and composites. This still reminds of the old method of representing the tens by knots. The same division of the numbers into three classes is generally found among the late Roman writers under the classification in digits, articles and composites. (75) It is usually assumed that this terminology is based upon finger-symbolism, (76) *digits*

(72) LOCKE, *ib.*, p. 32; SMITH, *ib.*, pp. 195, 196.

(73) LOCKE, *ib.*, p. 39; see above § 13, near note 50.

(73a) See the writer's paper « Did the Arabs Know the Abacus? », in *The American Mathematical Monthly*, vol. 34, p. 315; SMITH, *loc. cit*,. II, p. 156; CANTOR, *loc. cit.*, I, 4th ed., p. 131.

(73b) Cf. *Babli Menaḥot*, 42a, *abeq leho mebaq*, and the commentaries of RABBI GERSHOM, Rashi and Tosafot, *ib.* The Tosafot use also the noun *ebeq* for loop, knot. See also the dictionaries of JASTROW, p. 8; LEVY, I, p. 14; BEN IEHUDA, p. 36; Aruch Completum, I, p. 16.

(73c) Cf. CANTOR, *loc. cit.*, pp. 674-75 : Mit Knoetchen versehene Schnuere stellen die Zahlen 1-10 dar... Nur schwach vermutend moechten wir darauf hinweisen, dass der Swan pān aus den Knotenschnueren vielleicht seine Entstehung genommen haben kann ».

(74) See *Algebra* of ALKHOWARIZMI, ed. ROSEN, Arabic text, p. 15.

(75) See SMITH, *loc. cit.*, II, pp. 12 sqq; CANTOR, *loc. cit.*, pp. 583, 802, 804, 840-41, 909.

(76) SMITH, *loc. cit.*

meaning fingers, and *articuli*=joints. The fact, however, is that in the extant works on finger reckoning the joints, or the bent fingers, do not symbolize tens and hundreds only, (77) and that the terms *digiti*, *articuli* do not appear in the places where finger symbolism is mentioned, but are commonly used by Abacists and Algorithmics alike. (78)

The writer, therefore, thinks that the term *articuli* is to be rendered as knots, which indeed is the original meaning of *articulus*, a « knot that *joins* and *binds* » the parts of the finger. In a great part of all the languages the same expression is used for both the joints and knots. The Arabic *'aqd*, Latin *articulus*, Greek *gony*, and our *joint*. In DANIEL (5, 6) « so that the *joints* of his loins were loosed » (79) it is literally « the knots of his loins ». In later Hebrew the joints are called « the knots of the fingers », (80) the Latin translations of the above mentioned passages of ALKHOWARIZMI use both terms, *articuli* and *nodi* (knots), for the Arabic *'aqd*. (81)

In further corroboration of this opinion we find that the Greek and Latin numerals express the tens by εἴκοσι = viginti = 20 : τριάκοντα = triginta = 30 : τετταράκοντα = quadraginta = 40 etc. There is no satisfactory etymology for the words « *konta*, *ginta*, *kosi*, *ginti*, indicating the tens. (82) The writer would suggest that the word *konta*, *ginta* comes from the Greek γόνυ, γόνατα, *gony*, *gonata*, meaning « knee, joint, knot ». *Triakonta* = *triginta* means three knots, *tettarakonta* = *quadraginta* means four knots etc. We find thus that all these terms for the tens *'uqud*, *articuli*, *konta*, *ginta* have the original meaning of knots and go back to the primitive stage of the knot-abacus.

19. *Knotted Cords as Registers and Accounts.* — Very early,

(77) SMITH, *loc. cit.*, II, pp. 196 sqq.

(78) SMITH, *ib.*, p. 13; CANTOR, *ib.*, p. 909.

(79) *Weqitrê harsêh.*

(80) *Qishrê 'eṣba'ot*; see the dictionaries to the Talmud under *qesher*.

(81) The LIBRI and BONCOMPAGNI texts have *articuli*; ROBERT OF CHESTER has *nodi*; see KARPINSKI in *Bibliotheca Mathematica*, XI, (1910-11), p. 129; CANTOR, *loc. cit.*, p. 802. ROSEN in his English translation gives « greater numbers » which is wrong altogether. Conf. still ENESTRÖM in *Bibliotheca Mathematica*, XI (1910-11), p. 334 and Vol. VIII (1907-8), p. 151.

(82) PRELLWITZ, *Etymologisches Wörterbuch der griechischen Sprache*, pp. 128-129, thinks that it is derived from δέκα = decem; εἴκοσι = two + (d) κητι; τριάκοντα = tri + (d) κητι, etc. But it seems to be too far fetched.

however, the mathematical knots and the mnemonic, historical knots were combined to a highly elaborate system of records and accounts used in the administration of the taxes, tributes and other governmental affairs. This system of knot-accounts « has often caused wonder to the Spaniards, who saw that their own best accountants made mistakes in their arithmetic, while the Indians (the Incas) were so accurate in their calculations that the most difficult were easy to them. They knew a great deal of arithmetic, and had an admirable method by knots made on strings of different colours, of keeping an account of all the tributes in the kingdom of the Yncas, both paid and still due. They added up, and multiplied by these knots, and to know what portions referred to each village, they divided the strings by grains of maize or small stones, so that their calculation might be without confusion. As every subject, whether relating to peace or war, to vassals, tributes, flocks, laws, ceremonies, or any other department, had special accountants who studied their special branches of administration, the counting was performed with facility ». (83) The knot supplied an account of everything. The Indians made strings of various colours... They were strung on a thicker cord from which they hung in a manner of a fringe. The thing to which a string referred was understood by its color, for instance a yellow string referred to gold, a white to silver, and a red one to soldiers. Things which had no color were arranged according to their importance... First would come wheat, next barley, next beans, next millet, etc. ». (83)

By the same means, as we learn, (84) « the tax-gatherers in the Island of Hawaii kept accounts of all articles collected by them from the inhabitants. A rope four hundred fathoms long was used as a revenue book. It was divided into numerous portions corresponding to the various districts of the island; the portions were under the care of tax-gatherers, who with the aid of loops, knots, and tufts of different shapes, colours and sizes, were enabled to keep an accurate account of the hogs, pigs, and pieces of sandalwood, etc., at which each person was taxed ».

19a. *Cord Registers and Note Books in the Bible.* — The probability is that the average business man availed himself of the same

(83) Report of GARCILASSO DE LA VEGA quoted by LOCKE, *ib.*, p. 39, 40.
(84) LOCKE, *ib.*, p. 63.

device for his practical purposes. Even as we today have with us a small note book, so might people at that time have carried some cord or line, more or less ornamental according to their means, in order to record various dates and numbers by different knots. This assumption might again help us to a better understanding of some passages in the Bible.

In the story of JUDAH and TAMAR, *Genesis* 38, 16-18 and 25, we read that TAMAR asked from JUDAH, as a pledge, his signet, his *cord*, and his staff. Later on, when she was going to be burnt for harlotry, she sent word to JUDAH : « By the man, whose these are, am I with child. Discern, I pray thee, whose are these, the signet, and the *cords*, and the staff ». We see that JUDAH carried no money with himself. The things mentioned are the customary personal belongings that a gentleman at that time would have in his possession, the signet, the staff, and the cord. We understand very well the use of the signet and of the staff. The ancient Babylonians and Syrians used to make a formal contract for all business transactions and to have each party seal the contract with his signet. The signet ring and the staff, which was often carved and highly ornamental, would be the most personal possessions of a Sheikh, and, as pledges, a most certain means of identification. (84a) But what was the use of the cord ?

Now, the old Hebrew commentaries felt the difficulty, and, being unable to account fot the use of the cord, tried to explain the Hebrew word *patil* differently as garment, shawl, or girdle. (84b) However, the meaning of the word *patil* is cord. The modern commentaries and translations do render it as cord, but the explanation given is that it was the cord on which the signet hung.(84c) The cord, however, seems to be, like the staff, something different, that has nothing to do with the signet, and besides there were several cords, as it is evident from verse 25 using the plural. (84d)

The writer, therefore, thinks it the most probable thing to be that those cords were a kind of a quipu note book, or register.

(84a) See BENZINGER, *Hebraeische Archaeologie*, 1894, p. 258; the Cambridge Bible, GUNKEL, and DRIVER, *Genesis*, *ad loc.*

(84b) Cf. TARGUM, RASHI, RAMBAN, the *Mahberet* of Parhon, the Beur etc.

(84c) See the Cambridge Bible, DRIVER, DILLMANN etc.

(84d) This was also recognized by GUNKEL, who says : « Doch scheint der *patil* (*patelim* 25) ein Gehaenge fuer sich gewesen zu sein. Eine Schnur mit Amuletten. »

Some of the cords were knotted and some not, thus representing both the written and blank pages of the note book. JUDAH went with his partner, the Adullamite HIRAH, to his sheep-shearers at Timnah to shear his sheep. It is only natural to assume that this was the best occasion to make the balance of the year, to take stock of the business, to check up the accounts and records of the shepherds, and to settle accounts with his partner. So he took along his books and records.

In the same way we have to explain the vision of EZEKIEL, 40, 3 seqq. The prophet saw a man « with a line (84e) of flax in his hand, and a measuring reed », who took down the exact measures of the future temple as recorded in chaps. 40-43. Since the reed was the measuring instrument, whatfore did he hold the cord of flax in his hand? All the commentaries (84f) think that the line of flax was also used as a measuring instrument, especially for the larger measures. The fact, however, is that only the reed is mentioned, here and later, (84g) in connection with the measurements. It is also clear that every surveyor and architect must have a note book to record the various measures and numbers. This exactly, in the writer's opinion, was the purpose of the line of flax. It was the blank note book, wherein the architect recorded all his data. (84h)

20. ***The Publican's Knot.*** — Somewhat similar revenue-books consisting of knotted cords were usual in Palestine under the Roman government at around 200 C. E. The Talmudic sources, (85) wanting to demonstrate how little reliable the character of a woman is, and how all depends on what kind of a husband she marries, tell the following characteristic story: One woman married first a religious scholar and used to tie the phylacteries around his hand. Later on she married a publican (86) and used

(84e) The Hebrew word is again *patil*, cord.

(84f) See RASHI, QIMHI, SMEND, ORELLI, and DAVIDSON in the Cambridge Bible.

(84g) 42, 16-19.

(84h) The same term *patil* is also used for the cord of blue in the law of fringes; see § 13 near note 46.

(85) See *Tosefta Dammai*, II, 17, ed. ZUCKERMANDEL, p. 48; ed. A. SCHWARZ, Wilna 1890, p. 104; *Babli Aboda Zara*, 39a; *Bekhorot* 30b.

(86) The publicans and tax-collectors were identified with sinners and most degraded persons in the literature of the Talmud and of the New Testament; see *Jewish Encyclopaedia*, X, p. 265 sq; SCHÜRER, *Geschichte des jüd. Volkes*, I, Leipzig, 1901, pp. 477-79.

to tie the knotted strings of the publican around his hand. These latter ones are called « the publican's knots », (87) and in contradistinction to the holy knots of the phylacteries were most odious and unpopular as a means of oppression and extortion and as the symbols of the hateful rule of the Romans.

There must have been two sizes of the publican's knots. A large rope, as described by LOCKE in the preceding paragraph, serving as a revenuebook and remaining in the hands of the tax-collector, and a great amount of very small knots, that were given out as receipts to the people who paid the duty. To carry even such small sized receipts on a Sabbat day constituted a violation of the Sabbat law. (88)

V. KNOT LETTERS OR KNOT NUMERALS.

21. *Knot Receipts.* — There were, however, two kinds of such publican's knots of the smaller size. 1) Real knots, or knotted strings given by the tax-collector as receipts. The probability is that originally they used very small strings, knotted in a perticular way, not known to all the people, and serving as receipts. The wife of the publican used to prepare such knots for him. (89) 2) Later on, they found it more practical to write receipts. The written receipts were also called « publican's knots », because their signs, letters or numerals, imitated and substituted the former knots. So we read in the *Mishna* (90) that anybody, who, on the Sabbat day, carries paper of such a size that a publican's knot can be written upon it, or if he carries a real (91) publican's knot, is guilty of violating the Sabbath. The *Gemara* then comments upon the *Mishna* that a publican's knot consists of two letters and that there were two kinds of letters, the usual alphabetic letters, being of a smaller size, and the knot letters,

(87) *Qishre Mokhes.*

(88) See *Mishna Shabbat*, VIII, 2; *Gemara* and *Rashi*, *ib.*, 78 a and b; *Tosefta*, *ib.*. VIII, II, ed. ZUCKERMANDEL, p. 120.

(89) Cf. also *Yer. Sheqalim*, VII in the beginning, f. 50 *yeḫkmūn qitrēhōn* « let the wine sellers recognise their knots » that were made as seals on the skin vessels. See also above, note 51.

(90) *Shabbat*, VIII, 2, 78 a/b.

(91) That is the writer's explanation of the *Mishna*. *Tosafot*, ib. 78b., v. *whamosf'*, do not make this distinction, and explain the text otherwise.

being of a larger size. According to Rabbi HANANEL of Qairuan (c. 990-1050) (92) these knot letters were Greek letters that are larger than the Hebrew ones. From the words of Rabbi HANANEL it appears that he knew some different knot letters that were common at his time. More than a century later, MAIMONIDES, in commenting upon this *Mishna*, informs us that in his time still the symbols and figures (numerals), that were employed for computations in the registers of the accountants, were called « the Roman Knots ». (93)

22. *The Ghobar Numerals, or Apices, are Called Roman Knots.* — MOSES BEN MAIMON, the famous Jewish philosopher, lived 1135-1204 in the western part of the Arabian Empire. He was born at Cordova and lived in Spain till 1160, then he went to Fez where he stayed till 1165, and finally settled in Egypt. His commentary to the *Mishna* was composed in the years 1158-1168, mostly while living in Spain and Fez. There can be no doubt about it that in speaking of « the symbols and figures employed for computation in the registers », MAIMONIDES refers to the West-Arabian numerals, also called the Ghobar numerals. These numerals considerably differ from the Hindu-Arabic numerals, called the East-Arabian numerals, but are of a striking similarity to the *apices*, or abacus-numerals, that occur in the geometry of BOETHIUS (c. 510). It is true the authenticity of this passage in the BOETHIUS geometry is questioned by many scholars. At any rate these numerals are found in Spain as early as the 10th century, and were possibly first introduced in Christian Europe by GERBERT (c. 980), who later became Pope SYLVESTER II (999).(94) We also know that the word *ghobar* is the Arabic term for the abacus and that ghobar numerals are identical with abacus numerals. (95)

The new and interesting fact that we now learn about them,

(92) See his commentary *ad locum*, quoted also by Rabbi NATHAN B. JEHIEL of Rome (1035-1106) in his dictionary; cf. *Aruch Completum*, VIII, p. 183 :

(93) Instead of *uqar alrûmî* in the Hebrew translation read *uqad alrûmî*. The original Arabic text, in the three manuscripts extant in the Library of the Jewish Theological Seminary of America, and in the edition of the Arabic text by Dr. M. KATZ, Budapest 1903, was used by the writer.

(94) Cf. SMITH, D. E., *History of Mathematics*, II, pp. 72-76; CANTOR, *Geschichte der Mathematik*, I, 4th edition, pp. 584, 711 and the plate of the numerals at the end of the book; SARTON, *Introduction to the History of Science*, p. 670.

(95) See the writer's article « Did the Arabs know the abacus ?» in *The American Mathematical Monthly*, vol. 34 (1927), p. 315.

is that still in c. 1160 the common and popular name for these numerals among the West-Arabians was « Roman Knots ». This fact is apt to throw a new light upon the whole subject. It shows first their Roman origin and « that they evidently came through a different channel, although from the same source ». (96) It further indicates the possible connection of these so called abacus numerals with the primitive knotted-cord-abacus and knot-numerals still used by the Roman publicans and tax collectors at about 200 C. E.

23. *Knot Letters in the Phylacteries.* — Among the Peruvian quipus the knot resembling the figure eight (8) occurs most frequently. (97) We have seen above (98) that the knots of the phylacteries had to imitate certain letters of the Hebrew Alphabet. Historically, however, the converse of it might be the truth, namely, that some letters of the alphabet and some of the numerals represent and imitate certain knot-forms. It is worthy of note that the letters are called in Hebrew *oth* « a sign, symbol » and that the same word is used of the knot symbols of the phylacteries : « And thou shalt *bind* them for a sign (*oth*) upon thine hand ». (99) The letters were, in fact, only new, written symbols substituting the old knot symbols.

24. *Egyptian and Chinese Knot-Letters.* — Similarly, we find pictorial representations of knots in the Egyptian hieroglyphs and in the Chinese script. « The (100) ancient Egyptians were, without doubt, familiar with similar methods of tying knots in cords for the purpose of calling to mind certain matter of information. This appears evident from the fact that one of the hieroglyphic symbols consists of the representation of the knotted and looped cord itself. (101) The celebrated Chinese historical work,

(96) SMITH, *loc. cit.*, II, p. 73.

(97) LOCKE, *loc. cit.*, p. 15.

(98) See § 12, p. 197?

(99) Deuter. 6, 7 and above, p. 198?

(100) WALTER JAMES HOFFMAN, *The Beginnings of Writing*. pp. 136-140, quoted by LOCKE, *ib.*, pp. 60-61; cf. also LOCKE, p. 55.

(101) In this connection we might well mention the Egyptian Harpedonaptae : cf. about them CANTOR, *loc. cit.*, p. 104; SMITH, *loc. cit.*, I, p. 81; II p. 288; PEET, *Rhind Papyrus*, p. 32; the writer's paper « On Three Interesting Terms Relating to Area » in *The American Mathematical Monthly*, vol. 34, p. 82. These were not only the « rope stretchers », the *geometers* and surveyors, handling the measuring cord, who were able to stretch a cord so as *to construct a right angle*; they perhaps

entitled *Yih-King*, mentions that previous to the invention of writing there had existed in China a conventional mnemonic process of tying knots in cords. In the appendix to the work named, CONFUCIUS says: « In great antiquity knotted cords served them for the administration of affairs. During the following generation, the saintly man FOU-HI replaced these by writing ». « Legend... places the tying of knots in strings at about 2800 B. C. when FO-HI invented eight symbols, and at the same time pictorial representations of these knotted strings were taken to represent the object thereby symbolized ». (102)

25. *From the Knot to the Alphabet. Conclusion.* — Here is the beginning of the end. In the invention of writing mankind created a tool that was by far superior to the primitive, clumsy knot. The knot was now discarded and came into oblivion. It proved to be a failure, by which human progress was sidetracked. However, the institution of the knot deserves a place in the history of civilization. It demonstrates the zigzag way evolution took in the development of the alphabet, it shows the struggle of the human spirit towards light and perfection.

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were also the « rope knotters » (ἅπτω means « to tie, knot »), the Egyptian *arithmeticians* and quipucamayu, who knew to record numbers, keep accounts and to calculate by the aid of knotted cords. More about that the writer hopes soon to publish in a special paper on « Harpedonaptae. »

(102) Cf. also CANTOR, *loc. cit.*, p. 88; SMITH, *loc. cit.*, I, p. 139; II, p. 195; and above, note 73c.

Medallic Illustrations of the History of Science

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Eighth Article.

This collection of scientific medals began to appear in volume 8 of *Isis*. The seventh article appeared in volume XIII, p. 353-55, pl. 5-8, 1930. The Editor will welcome photographs or suggestions for the following parts of this series. It is intended to publish only medals having a sufficient scientific and artistic interest. Medals dedicated to scientists who are still living can not be published at once, but will be considered for ulterior publication. GEORGE SARTON.

No. 41. CHARLES ADOLPHE WURTZ. French chemist. Born near Strasbourg, 1817; died Paris, 1884. Organic chemistry. Elaboration of the atomic theory. *Cours de philosophie chimique* (1864); *Histoire des doctrines chimiques* (1869); *Dictionnaire de chimie* (1869-78); *La Théorie atomique* (1878); *Traité de chimie biologique* (1880-85); etc.

Artist : ALPHÉE DUBOIS. French medallist (Paris, 1831; Clamart, Seine, 1905). (FORRER, 1, 631-33, 1904; 7, 236, 1923).

Date : 1886.

Size : 68 mm.

Collection : LYMAN C. NEWELL, Boston.

Obv. : Portrait (fig. 58). CHARLES ADOLPHE WURTZ, 1817-1884. ALPHÉE DUBOIS, 1886.

Rev. : Dictionnaire de chimie pure et appliquée. Découverte des ammoniaques composées. Découverte des glycols. La théorie atomique. Traité de chimie biologique. (Fig. 59). ALPHÉE DUBOIS.

No. 42. JOSEPH LEIDY. American zoologist. Born, Philadelphia,

1823; died, Philadelphia, 1891. Studies of parasitology, protozoology, palaeontology, human and comparative anatomy, etc.

Artist : JOHN R. SINNOCK, engraver in the United States Mint, Philadelphia.

Date : 1923.

Size : 4 × 2.5 inches.

Collection : JOSEPH LEIDY, jr.

Obv. : Portrait (fig. 60). JOSEPH LEIDY. J. R. S. MCMXXIII.

Rev. : JOSEPH LEIDY, 1823-1891. The Academy of Natural Sciences of Philadelphia... (Space for the name of the person to whom the medal is awarded).

No. 43. AUGUSTE COMTE. French philosopher. Born, Montpellier, 1798; died, Paris, 1857.

Artist : S. E. VERNIER. French medallist. Born, Paris, 1852.

Date : 1902.

Size : 47 × 32 mm.

Collection : Cabinet des Médailles, Paris. (Coutesy of Mme. H. METZGER).

Obv. : Portrait (fig. 62). AUGUSTE COMTE. Fondateur du Positivisme, 1798-1857. S. E. VERNIER, 1902.

Rev. : Reproduction of statue (fig. 61). Ce monument élevé à AUGUSTE COMTE par souscription internationale, a été inauguré le 18 mai 1902 à Paris. INJALBERT, statuaire.

Ordre et progrès. Vivre pour autrui. Famille, patrie, humanité.

No. 44. JEAN BAPTISTE LAMARCK. French biologist. Born at Bazentin, Picardie, 1744; died, Paris, 1829. Theory of evolution in his *Philosophie zoologique*, 1809. *Histoire des animaux sans vertèbres*, 1815-22.

Artist : F. SICARD. French medallist.

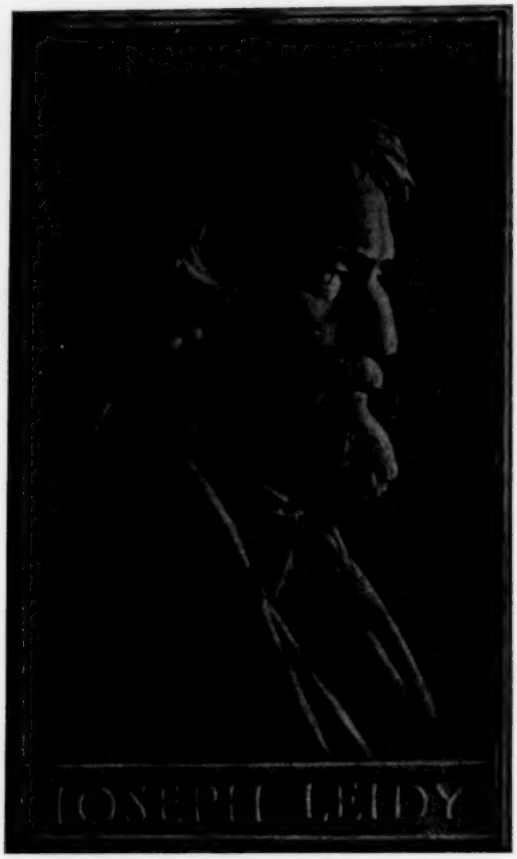
Size : 47 mm.

Collection : Cabinet des Médailles, Paris. (Coutesy of Mme. H. METZGER).

Obv. : Portrait (fig. 63). LAMARCK, 1744-1829. F. SICARD.

Rev. : Museum national d'histoire naturelle. (Open space to engrave name of person to whom the medal is awarded).

No 41. Wurtz.
(Figs. 58, 59.)



No 42. LEIDY.
(Fig. 60.)

No 43. COMTE.
(Figs. 61-62.)

No 44. LAMARCK
(Fig. 63.)

No 45. BICHAT
(Fig. 64.)

No 46. Poncelet
(Fig. 65.)

No 47. Arago
(Fig. 66.)

No. 45. Marie François Xavier Bichat. French anatomist. Born at Thoirette, Jura, 1771; died Paris, 1802. One of the founders of general (or descriptive) anatomy. ***Traité des membranes*** (1799-1800). ***Anatomie descriptive*** (5 vols., 1801-1803).

Artist : L. Dubour. French medallist of the first half of the nineteenth century, who made but very few medals (Forrer, 1, 639, 1904).

Date : 1920.

Size : 42 mm.

Collection : L. J. Henderson, Cambridge, Mass.

Obv. : Portrait (fig. 64). M. F. X. Bichat. L. Dubour.

Rev. : Oak and laurel branches. Congrès de Physiologie, Paris, 1920.

No. 46. Jean Victor Poncelet. Born in Metz in 1788; died in Paris 1867. French mathematician and engineer. ***Traité des propriétés projectives des figures.*** Paris, 1822. Principle of geometrical continuity; method of reciprocal polars; principle of duality (implied).

Artist : Eugène André Oudiné. Born, Paris, 1810; died, Paris, 1889. French sculptor and medallist.

Date : 1869.

Size : 50 mm.

Collection : G. S.

Publisher : Monnaie, Paris.

Obv. : Jean Victor Poncelet. Membre de l'Institut. (Portrait, fig. 65).

Rev. : Né à Metz, 1788. Lieutenant du génie, 1812. Professeur à l'école de Metz, 1824. Membre de l'Académie des Sciences, 1834. Professeur à la Faculté des sciences de Paris, 1837. Représentant du peuple, 1848. Général de brigade, 1848. Commandant de l'École polytechnique, 1848-50. Gd. Or. de la Légion d'honneur, 1853. Mort le 23 décembre 1867.

No. 47. (Dominique, Jean) François Arago. Born in Estagel, Roussillon, 1786; died in Paris, 1853. French physicist. Study of optical polarization and other optical phenomena, etc. Popularization of science.

Artist : ALPHÉE DUBOIS (1831-1905). French medallist and sculptor. Born at Paris in 1831; died at Clamart, Seine, 1905. (FORRER's *Dictionary*, vol. 1, 631-33, 1904; vol. 7, 236, 1923).

Size : 67 mm.

Collection : D. E. SMITH.

Obv. : FRANÇOIS ARAGO, 1786-1853 (fig. 66). ALPHÉE DUBOIS, d'après DAVID D'ANGERS.

Rev. : Institut de France. Académie des Sciences. Médaille Arago. Laudes damus posteri gloriam. (laurel branch).

Notes and Correspondence

1. The History of Science.

International Committee of the History of Science. Address : Hotel de Nevers, 12 rue Colbert, Paris.

When the organization is completed, it will include two kinds of members, thirty full members (membres effectifs) and fifty corresponding members. Thus far (end 1929) 23 full members and 37 corresponding members have been elected. For more information see ***Archeion***, the archives for the history of science published by ALDO MIELI (address, same as above).

A list of members follows :

Full members

F. CAJORI
F. M. FELDHAUS
C. H. HASKINS
Sir T. L. HEATH
L. KARPINSKI
E. O. v. LIPPMANN
G. LORIA
H. METZGER
A. MIELI
M. NEUBURGER
E. RÀDL
A. REY
J. RIBERA Y TARRAGO
J. RUSKA
G. SARTON
H. E. SIGERIST
C. SINGER
D. W. SINGER
D. E. SMITH
R. STEELE
K. SUDHOFF
L. THORNDIKE
H. WIELEITNER

Corresponding members.

R. ALMAGIÀ
R. C. ARCHIBALD
M. ASIN Y PALACIOS
L. A. BIRKENMAJER
L. BRUNSCHVICG
CARRA DE VAUX
M. CAULLERY
E. DARMSTAEDTER
P. DELAUNAY
P. DIEPGEN
H. DINGLER
H. DRIESCH

F. H. Garrison
R. T. Gunther
T. de Györy
A. Haas
Ing. Hammer-Jensen,
J. E. Holmyard
M. Meyerhof
Y. Mikami
G. A. Nallino
E. Nordenskjöld
T. E. Peet
A. Reymond
J. Schuster
H. E. Stapleton
F. Strunz
D'A. W. Thompson
J. Tropfke
A. Tschirch
A. V. Vassilieff
Q. Vetter
W. H. Welch
M. Wellmann
E. Wickersheimer
J. K. Wright
E. Zinner.

Officers of the Committee
until the London meeting of July 1931.

President : Singer.
Vice-presidents : Cajori, Rey, Sudhoff.
Permanent secretary : Mieli.
Treasurer : Sigerist.

Section L of the American Association for the Advancement of Science. Sub-section on Historical Sciences. — Program of Section L. — At the Des Moines Meeting (Dec. 28-30, 1929), Section L has been sub-divided into two groups, one on Historical Sciences and the other on Linguistic Sciences. The meetings of those two groups will be held separately.

The sub-section on Historical Sciences is usually represented at the meeting of the A. A. A. S. by the *History of Science Society*, but this is meeting elsewhere this year so that the program has been prepared as an integral part of the A. A. A. S. Two Sessions have been provided for on Saturday December 28th at the Hotel Fort Des Moines, Club Rooms One and Two, one on the History of Agriculture and the other on Historical Sciences. A trip has also been arranged through the Archives of the State of Iowa of which Dr. E. H. Harlan is superintendent. Arrangements will be made to take a group of from 25 to 50 members on a tour of inspection of the archives at a time most suitable to the group, probably on Saturday afternoon, December 28th, following the afternoon session of the Sub-section. The program is as follows :

I Morning session on History of Agriculture, Saturday, December 28th, Fort Des Moines Hotel, Club Rooms One and Two, 10 a.m.
Prof. Chas. E. Payne, of Grinnell College, Presiding.

1. *Introductory remarks* by Prof. CHAS E. PAYNE of Grinnell College.
2. The *Agricultural Revolution in the United States* 1860-1930, by Prof. L. B. SCHMIDT, Iowa State College (Thirty to forty minutes).
3. *Some Pre-Revolutionary Correspondence on Agriculture*, by Prof. RODNEY H. TRUE, University of Pennsylvania (Twenty to thirty minutes).
4. *Adobe Brick as a Source of Agricultural History*, by Prof. GEORGE W. HENDRY, University of California (Twenty minutes).
5. Discussion to be led by Prof. EARL D. ROSS, Iowa State College.

II Afternoon session on Historical Sciences, Saturday, December 28th, Fort. Des Moines Hotel Club Rooms One and Two, 2 p. m. Prof. W. T. ROOT, University of Iowa, Presiding.

1. *Science and the New History*, by Professor IRVING B. RICHMAN, Muscatine, Iowa.
2. *Some Means of Collecting Indian Lore*, by Mr. EDGAR H. HARLAN, Historical Building, Des Moines, Iowa.
3. Discussion led by.....
4. Also a tour of the Archives of the Historical Memorial and Art Department of the State of Iowa, and the personal Archives of Mrs. E. D. SPAULDING, to be arranged by Mr. E. H. HARLAN, Curator, and Mr. CASSIUS C. STILES for between 25 and 50 visitors, Saturday afternoon December 28th following the afternoon session.

III Attention is called to the address of Prof. R. C. ARCHIBALD of Brown University entitled « Mathematics before the Greeks » which will be presented on Monday afternoon December 30, at a joint session of Section A and the American Mathematical Society.

2. Queries and Answers.

Answer 3. 2. — GIOVANNI DE' FONTANA.

In addition to my previous reply (*Isis*, 13, 103, 1929) to Dr. SARTON's Query (*Isis*, 7, 105, 1925) I have now to call attention to another manuscript of another work by this author. It is a long work on the measurement of altitudes, latitudes, and the like, and the instruments to be employed therein, and is entitled *De trigono balistario*. The author, IOHANNES FONTANA, is described as a Venetian and *physicus*, *medicus*, and as such he drew a salary at Udine. In other words he was employed as the municipal physician of that town. The work in question was finished there in 1440 on the last day of February, and our manuscript is presumably the autograph. « Editus et expletus est tractatus iste de trigono balistario anno gratie M° CCCC° xl° in Utino die ultimo Februarii per IOHANNEM FONTANUM Venetum physicum medicum eodem in loco salariatum ad laudem omnipotenti dei... » The preface, addressed to

a Venetian named DOMINIC BRAGADINO, opens, « Postquam domino deo nostro vero sublimi glorioso et eterno... » The text begins, « Inveni superfitiem planam latam atque rectissimam solidam et permanentem parietis... »; and closes, « ... iterum vale et utinam numerus annorum Methusalem et sapientiam Salomonis bene transcendere possis. » The manuscript, Codex Canonicus Miscellaneus 47. chart. quarto maiori, fols. 223, is now in the Bodleian Library, Oxford, and is one of those purchased in 1817 by that library from the library of the abbot, M. L. CANONICUS, of Venice. It is described in HENRY O. COXE catalogue of the Canonicus collection, printed at Oxford in 1854, col. 465. I had time only to glance over the codex briefly on September 4, 1929, since I was leaving Oxford the next day, and other manuscripts claimed my attention at the same time. The work is divided into chapters, of which the first thirty are numbered and given titles, while blank spaces have been left for these at the beginning of the subsequent chapters. My recollection is that the text was liberally illustrated with geometric figures. The title, *De trigono balistario*, did not seem wholly justified. The triangle did indeed seem to play a basic part in JOHN's instruments for measuring, but the treatise did not appear to deal primarily with the theme of ballistics. To characterize it adequately, however, further examination and study of the manuscript would be needed.

Columbia University, New York. LYNN THORNDIKE.

Question no. 13. — Falconry in ancient Egypt. Was falconry practised by the ancient Egyptians? (This question was addressed privately to M. JEAN CAPART in Brussels, but his answer was so instructive, that I obtained his permission to publish it in *Isis*). G. S.

Answer no. 13. — « Je ne crois pas qu'il existe une étude quelconque sur la fauconnerie dans l'ancienne Egypte. Pour moi, il n'y a pas de doute qu'elle ait existé. Comment comprendre sans cela des images comme celle de MASPERO, Histoire ancienne des Peuples de l'Orient classique (t. I, p. 101). On y voit Horus vainqueur de la gazelle. Vous trouverez d'autres exemples dans le grand catalogue du musée du Caire, DARESSY : Textes et dessins magiques (pl. 3, 4 et 10). Les Egyptiens employaient, à la chasse, des oiseaux de proie dressés, comme on le voit entre autres par la belle peinture du British Museum (Art égyptien, pl. 75 ou BUDGE, A guide to the third and fourth Egyptian rooms, 1904, pl. 2). »

Bruxelles, 15 octobre 1929. JEAN CAPART.

3. Miscellanea.

Science and international coöperation. — *Wheelbirks, Stocksfield,*

Northumberland, October 6, 1929. Sir, A specimen copy (June 1928) of « *Isis* » kindly sent to me from Belgium lies beside me, for which many thanks. There has been some recent inquiry from Armstrong College, Newcastle for data on the history of Science.

I have been reading the magazine received in order to find out what periods in the history of Science are chiefly interesting you.

There is one period which is not represented in your No. 34 Vol. X (2), that is *the XXth. Century the years* 1901-29.

It is of course just in the immediate past that it is most difficult to know which events will still seem significant when judged by the standards of the day after tomorrow, but also it is the history of the immediate past which is of greatest value for guidance in the immediate future, and moreover it is just these years which still have their records in living memory which if they are to be preserved at all should be saved before these memories become extinct.

One large movement of the quarter century has been the *development of the international scientific societies*. It has I think not yet found any competent historian. It has had small beginnings in individual enterprise and voluntary cooperation. In its embryonic stages it has not been a state-official movement or even a state-aided movement. Hence the need for historical record of small beginnings. The first intervention of the states seems to have been in the wrecking of the pre-war international scientific societies and the subsequent attempt to impose an allied international research council and affiliated unions with a limited conception of internationality.

On some of these events we may have different a priori opinions; but that is exactly the case for a record of verified facts to enable us to judge these movements by their consequences.

Subsequent developments include the formation of the League of Nations Committee on Intellectual Cooperation and the foundation of the International Institute of International Cooperation in Paris. It is not yet clear what these organisations will find themselves able to accomplish. Indeed on their present records one might even doubt whether any political or state organisation such as the Société des Nations is competent to lead and inspire scientific research. The best evidence to the contrary comes from the medical side from the Health Section of the S. d. N.

What has been done by the S. d. N. through its Section of International Bureaux is of real importance, although it hardly amounts to more than watching, recording and publishing what other people are doing. The reports in the « Handbook of International Organisations » show that the Geneva Secretariat is gradually making contacts with the various

voluntary international societies, for instance by sending representatives to their meetings. Another feature that emerges is that various *societies which occupy adjacent fields of interest are tending to federate among themselves*. The International Agricultural Coordination Commission is a case in point.

The general public are probably almost wholly ignorant of these developments. The sources to which they look for information, the politicians and the newspapers are silent and if not equally ignorant tend to treat international science as of nearly negligible importance.

What is much more serious is that the scientific and academic world, largely and rightly engrossed in specialist research, does not see or seeing does not realize the whole. In 1914 one or two sporadic attempts were made — by the botanists, by the international survey of the heavens — to continue their joint work. A very few scientific men refused under any conditions to prostitute themselves even in the service of their own belligerent governments. There was *no widespread general consciousness that the world was already united for the essential purposes of science and civilization* — No one who had the ear of the public suggested that a simple way of stopping wars would be for doctors, chemists, meteorologists and all other experts to withdraw their services from all belligerent governments without exception.

It is of course more difficult to do this when so many workers are already directly or indirectly paid by the state. Fifty years ago the clamour was to get the state to pay any attention at all to scientific advice. Twenty five years ago the policy of state grants to universities and scientific institutions was developing. Within a life time scientific research work has changed from being chiefly in amateur until now it is *chiefly in professional hands*. This is another large and hardly recorded change. It has a possible parallel in the way in which the Christian church came under the patronage of the Roman Empire, and although much is said about the disestablishment of the church we have not yet reached an era which demands the freedom and independence of scientific thought apart from its paymaster the state.

These lines are not written with the expectation of their publication in *Isis*, but rather in the hope of calling the attention of some or all of the associated editors to the desirability of chronicling existing movements whilst they still move.

Minimum steps might be to indicate where some of the relevant information is probably stored, e. g. in Brussels with Prof. P. Otlet, in Paris at the Institut International de Coopération Intellectuelle, in Oxford at the Ashmolean Museum, in London with the Foreign Secretary of the Royal Society.

A general bibliography would be very brief, but would include :

MERZ, J. I. : « A History of European Thought in the Nineteenth Century », 4 vols, BLACKWOOD.

FRIED, A. H., LA FONTAINE, H., OTLET, P., Editors : « Annuaire de la Vie Internationale », 1908-1909 and 1910-1911, Brussels.

FRIED, A. H. : « Das Internationale Leben der Gegenwart », 1908. TEUBNER, Leipzig being no. 226 of the series « Aus Natur und Geisteswelt » — out of print.

Royal Society of London : « Memorandum of Committee on International Scientific Organisations. May, 1918.

Société des Nations : « Bulletin Trimestriel de Renseignements sur l'œuvre des organisations internationales », 1922 onwards. Geneva.

League of Nations : « Handbook of International Organisations », Geneva.

WOOLF L. S. : « International Government. Fabian Bookshop, London, 1916.

MERZ takes the story of the general interactions of French, English and German thought up to the end of the XIX Century, but he hardly touches the era of international organisation. WOOLF writing in the turmoil of the war is completely conscious of the real movement of evolution, see pp. 196-205. The work done by Dr. A. H. FRIED and almost anonymously by Dr. NITOBE at Geneva will serve as an index to the movements as a whole, every separate society having its own publications. The future historian will be able to check many details by reference to the Indices of back volumes of « *Nature* » and to the addresses of the presidents and sectional presidents of the British Association for the Advancement of Science.

Yours truly. HUGH RICHARDSON.

It is not correct to say that the twentieth century is neglected in *Isis*, but the space devoted to it is relatively small. It is true it was not represented in no. 34, but every period cannot be represented in every number. However we feel that it is as yet impossible to write the history of science in our century, because we are too near to the events to see them in their true perspective, and even more so because a scientific theory can only be judged by its fruits. Of course contemporary events can be and should be chronicled but this is done best by journals especially devoted to it, such as *Nature*, *Science*, the *Revue générale des sciences*, *Die Naturwissenschaften*, *Scientia*, etc.

When *Isis* was founded it was hoped to devote considerable space to the organization of science (see original program in the first number, 1913; also vol. 1, 193-96 and passim), but that hope proved to be far

too ambitious, and we were gradually obliged, not without regret, to leave to others the accomplishment of that great task, and to apply most of our energy to the study of the past. One must not attempt to do too much at a time, and our program is already sufficiently vast as it is. We fully appreciated from the beginning the crucial importance of international collaboration, witness the paper « L'histoire de la science et l'organisation internationale » (*Vie internationale*, vol. 4, 27-40, 1913), and our repeated explanations of the unity of knowledge and the unity of mankind, as two aspects of a single truth. Indeed this may be said to be a sort of *Leit-motiv* in every number of *Isis*.

October 23, 1929. EDITOR.

Imhotep. Two statuettes in the Boston Museum. — JAMIESON B. HURRY's excellent book on IMHOTEP (2nd revised edition, Oxford, 1928 : *Isis*, 13, 373-75) gave me the idea of finding out whether the Boston Museum had any representation of him. As stated by HURRY there are a few in the Metropolitan Museum, and numbers of them must be scattered in the museums of the world. However my contribution to the IMHOTEP iconography must be limited to the museum nearest to me, the Boston Museum, which can boast an Egyptian collection of great importance.

There are two bronze statuettes of IMHOTEP in Boston, which are catalogued as follows :

Inventory number 03.1663 : Bronze statuette of IMHOTEP dating from the twenty-sixth to thirtieth Dynasties. Seated figure holding partially unrolled scroll on his lap. He wears a short skirt, broad necklace, and has bare feet. Height 95 mm.

Inventory number 27.984 : Bronze statuette of IMHOTEP of the late Egyptian Period. Seated figure wearing collar and short skirt and holding on his lap a scroll with incised inscription. Height 117 mm. From Giza : G 7632 Chamber I. Harvard-M. F. A. Expedition, 1925.

The first is at present on exhibition in gallery VII. case 3; the second is now in storage but will be exhibited shortly. Having examined both carefully, I considered the second more interesting, and asked Dr. REISNER's leave to publish it in *Isis*. This was kindly granted by him. I am thus able to offer our readers two views, three quarter and profile, of that charming statuette. Dr. REISNER's reading of the inscription on the scroll is :

« Imhotep, great one, son of Ptah, born of Khereduw-ankh (the princess, his mother).

The courtesy of Dr. REISNER and of his assistant, Miss GRACE W. NELSON, is deeply appreciated. GEORGE SARTON.

Isis, XIV, pl. 10

Bronze statuette of IMHOTEP (Boston Museum)

G. SARTON.

La Correspondance de N. Bowditch — Opinions de Le Gendre. — On conserve à la Boston Public Library (Boston, Massachusetts), trois volumes de correspondance relatifs à NATHANIEL BOWDITCH (1773-1838). (*) Quelques documents sont de la main du savant américain lui-même. Mais la plus grande partie des lettres recueillies ont été adressées à BOWDITCH à l'occasion de la publication (1829-1839) de son œuvre principale, la traduction en langue anglaise de la *Mécanique Céleste* de LAPLACE. Bien qu'il y ait là des signatures illustres, celles de BERZÉLIUS, DE LALANDE, ENCKE, JOHN HERSCHEL, LE GENDRE, QUETELET, etc. par exemple, l'historien des sciences chercherait en vain dans ces papiers des matériaux nouveaux ou des renseignements inédits. Les seules lettres offrant quelque intérêt me semblent être celles de LE GENDRE, soit pour les informations qu'il donne sur sa propre activité, soit à cause de son jugement sur LAPLACE, qui ne manque pas de piquant. Je transcris ici les passages les plus caractéristiques :

« Vous me demandez, Monsieur, si j'ai ajouté quelque chose aux trois volumes que vous connaissez de mes *Exercices de Calcul Intégral*. J'avais le projet il y a quelques années, d'en donner une seconde édition, mais j'ai préféré d'en extraire la partie principale et de la publier, avec beaucoup d'augmentations, sous le titre de *Traité des fonctions elliptiques*, en deux volumes in 4° avec un 3eme de suppléments dont il n'y a encore que deux d'imprimés. Ces suppléments sont relatifs à des découvertes très remarquables faites dans la même théorie par deux jeunes géomètres d'un talent extraordinaire, M. ABEL de Christiania qui vient de nous être enlevé par une mort prématurée et M. JACOBI de Koenigsberg qui promet de parcourir une longue et brillante carrière scientifique. » (4 février 1830).

« J'ai l'honneur de vous envoyer le troisième supplément qui complète et termine le troisième tome de mon traité des fonctions elliptiques. J'avais formé le projet de donner plus d'étendue à ce troisième tome, mais prêt à entrer dans ma 81eme année, j'ai pensé qu'il était tems de m'appliquer la maxime *solve senescentem*; D'ailleurs en allant plus loin je n'aurais pas la chance de terminer mon ouvrage aussi bien qu'il l'est par le 3eme supplément où vous verrez, monsieur, que j'ai réussi à tirer d'un beau théorème de M. ABEL, une nouvelle branche d'Analyse, restée jusqu'ici inconnue aux géomètres, et à laquelle j'ai donné le nom de *Théorie des fonctions ultra-elliptiques*. (2 juillet 1832).

... « Votre ouvrage n'est pas simplement une traduction avec commentaire, je le regarde comme une nouvelle édition augmentée et perfectionnée, telle qu'elle aurait pu sortir des mains de son auteur, s'il avait

(*) Sur BOWDITCH, voir la notice de R. C. ARCHIBALD dans le *Dictionary of American Biography* (SCRIBNER's), vol. 2 (1929), pp. 496-8.

connu ses véritables intérets, c'est-à-dire s'il avait cherché à être clair et s'il avait voulu être juste envers les autres auteurs qui l'avaient précédé ou qui étaient ses contemporains. Car son grand défaut était de ne pas citer et de vouloir s'attribuer exclusivement des découvertes qu'il n'avait pas faites. » (2 juillet 1832). J. PELSENEER.

Account of Isis from the year 1929. N.B. This account does not refer to the numbers distributed to our members in 1929 (37 to 40) but to those paid for in 1929 (36 to 40), a total of 1160 p., 22 pl., 31 fig. The year 1929 ended on February 10, 1930. For the sake of simplification, I have counted Belgian francs on the basis of 36 to the dollar (the real value fluctuated around 35.80).

Expenditures		Receipts	
Printing and mailing	$ 2393.74	H.S.S.	$ 1908.00
Brussels office	245.79	Back vols. (1)	578.81
Cambridge office	281.47	Belgian subscr.	296.93
Royalties	47.62	Gift from L.T.	100.00
Advertising	137.82	Interest	1.10
Total	3106.44	Total	2884.84
	2884.84	(1) Including those sold through H.S.S., 100.	
Net Loss	221.60		

Cost of printing and mailing per page (incl. plates) $ 2.06
Total publishing cost per page (incl. plates) 2.68

Of this total 1.64 was paid by the H.S.S.; 1.04 by the Editor.

Or, in other words, the H.S.S. paid for 673 p., 13 pl., and the Editor paid for 487 p., 9 pl.

The year 1929 was the most prosperous year in the whole history of *Isis*. For the previous account, see *Isis*, vol. 12, 176-77, 1929.

Cambridge, Massachusetts GEORGE SARTON.
February 12, 1930.

Archeion, Archivio di storia della scienza. — A la suite du premier Congrès international d'histoire de la science (Paris, 20-24 mai 1929), et pour établir une liaison entre The History of Science Society et le Comité International d'Histoire des Sciences, ALDO MIELI offre l'abonnement à prix réduit à *Archeion* aux membres de The History of Science Society, qui pourront recevoir *Archeion* aux prix de 90 fr. français s'ils habitent la France ou la Belgique, ou de 100 fr. français pour tous autres pays. Ils devront à cet effet s'adresser et envoyer leur contribution personnellement à LEON GUINET, 30 Av. de Brouckère, Auderghem, Belgique.

Reviews

Maqbûl Aḥmad. — *A Persian translation of the eleventh century Arabic alchemical treatise 'Ain aṣ-ṣan'ah wa 'aun aṣ-ṣana'ah.* To which is annexed a note on the chemistry of the processes given in the treatise, by B. B. DATTA. (*Memoirs of the Asiatic Society*, 8, 419-60). Calcutta, 1929 (Rs. 1.11.0).

Some parts of the history of science have been so well investigated that our knowledge of them is fixed for some time at least — I almost wrote : that our knowledge of them is dead, for however much a scholar may love knowledge, he loves even more the continuous effort to obtain it. It is the changing and living knowledge that matters. (There is a famous saying of LESSING on the subject, which I shall not quote however, not to spoil the reader's pleasure in remembering it himself). From that point of view, one of the most interesting chapters in the whole history of science, to-day, is that dealing with mediaeval chemistry, for it is one where our knowledge is rapidly developing. These studies on mediaeval chemistry imply the reading of a number of Arabic and Persian Mss., and this is being done in various countries, but nowhere better than in Calcutta.

The guiding spirit of what may be conveniently called, the school of Calcutta, is Mr. HENRY ERNEST STAPLETON, Principal of Presidency College. Four important papers of his on Muslim chemistry have already appeared in the *Memoirs of the Asiatic Society of Bengal* : 1. Sal-ammoniac (vol. 1, 25-42, 1905); 2. Alchemical equipment in the eleventh century, with R. F. AZO (vol. 1, 47-70, 1905); 3. An alchemical compilation of the thirteenth century, with the same (vol. 3, 57-94, 1910); 4. Chemistry in 'Iraq and Persia in the tenth century, with the same and M. HIDÂYAT ḤUSAIN (vol. 8, 317-418, 1927). This last paper was reviewed by me in *Isis*, vol. 11, 129-34.

In the second paper (1905), the authors described a previously unknown Arabic treatise, 'Ain aṣ-ṣan'ah wa'aun aṣ-ṣana'ah (Essence of the art and aid to the artisans), purporting to have been written at Baghdâd in 1034-35 (1) by ABÛ-L-ḤAKÎM MUḤAMMAD IBN 'ABD AL-MALIK AL-

(1) According to the Persian text the date was 1030. The Arabic date must be preferred, but the difference is immaterial.

ṢÂLIḤÎ AL-KHWÂRIZMÎ AL-KÂTHÎ (See my *Introduction*, vol. 1, 723). Unfortunately they had only an incomplete Ms. of it, but in 1925 Mr. STAPLETON found in the library of the Niẓâm of Hyderabâd, a Persian Ms. entitled Tarjumah 'ain aṣ-ṣan'ah, which proved to be an abbreviated summary of the whole Arabic treatise. Its study was intrusted to Mr. MAQBÛL AḤMAD, lecturer in Islamia College, Calcutta, and the present publication is the fruit of Mr. MAQBÛL'S efforts.

For a summary of the Persian treatise, I cannot do better than reproduce the editor's own words (p. 420). After some introductory matter, the Persian translator « goes on to give a similar list of chapters to that which precedes the list of names of the sages in the original. The first chapter deals with the names of substances and their division into ' spirits ' and ' bodies '. The second treats of the description of the characteristic properties of these substances. The third deals with manipulation (tadbîr) and experiment (tajribah), and the extent of their use. The fourth is the same in both Mss., i.e., what are the substances required for making silver (qamar) and gold (shams). The descriptions of the fifth and sixth chapters are also the same in both versions, viz. : — the fifth deals with the instruments for the substances (reading adwîyât for adwât — ' utensils ' of the Arabic text) : and the sixth with the substitution of one substance for another. The seventh chapter is here said to give the proportions of the substances to be used, and the method by which the work is most easily carried out with small quantities; but from the actual translation found later, it will be seen that the translator describes 4, instead of the 2, ' pillars ', or major operations, which are referred to in the catalogue at the beginning of the Arabic Ms. The translator also gives what may turn out to be the ' easy processes in every useful branch of the art ' that are mentioned in the Arabic text; and this forms by far the most interesting portion of the Persian text. These processes, however, are given under the separate heading of ' Chapter on experiment by testing and the use of proper quantities ' : and it is quite possible that this portion of the Persian text may be an altogether separate treatise. Reference is also made in it to ' four pillars ' but the processes given are quite different to those previously given in the rendering of the actual text of the 'Ain aṣ-ṣan'ah. »

A longer analysis follows (p. 423-37), including abundant notes. In one of these notes (p. 428) an extract from a previously unpublished portion of the Arabic text is Englished by Mr. M. HIDÂYAT ḤUSAIN, and that Arabic text itself is published in appendix (p. 459-60). This enables one to compare the Persian and Arabic texts.

The treatise is discussed from the chemical point of view by Prof. B. B. DATTA, of Presidency College. For the technical details I must

refer to the memoir itself, but I may quote some of DATTA's conclusions (p. 438-40).

« The 'Ain aṣ-ṣan'ah, as its name implies, contains the essentials of the chemical knowledge of the 11th century, with some practical hints for aiding the workers. The seventh chapter of the book in particular contains easy processes in every useful branch of the art as it prevailed at that time. The scope of chemical science in the Middle East was then almost entirely confined to a study of the common metals and their compounds. Experimental operations were guided mainly by the possibility of effecting the transmutation of baser metals into gold and silver — the avowed object of the alchemical art. It is therefore not at all surprising that the methods described in the chapter under consideration are apparently concerned with producing passable imitations of silver from cheaper materials, especially copper, or with bringing about external and superficial changes in colour in the cheaper and baser metal. The contents of the treatise remind one of those of the Egyptian papyrus manuscripts on the same subject described by BERTHELOT in his *Archéologie et Histoire des Sciences* (pp. 266-307) with this difference that, whereas the latter were intended for the guidance of artisans, the Arabic works are essentially practical treatises on natural philosophy, written in the cause of the advancement of science, and not therefore primarily for the purpose of amassing wealth by faudulent means. From the elaborate details given in the 'Ain aṣ-ṣan'ah it seems fairly obvious that the author had actually personally tested the various processes he describes... »

« According to modern ideas of chemistry, the methods described above will appear to be full of superfluous and unnecessary steps. But it must be remembered that it was BOYLE in the 17th century who first developed the theories of elements and compounds, as well as of analysis and synthesis, and thus laid the correct foundation of our modern science of chemistry. Before these principles were laid down, even great minds would necessarily waste their energies on superfluous detail, as they were not governed by correct theories, and hence their efforts were bound to be somewhat ineffective. The anthropomorphic view of matter based on Sufism, which, in turn, may very possibly have been based on Vedantism (the identity of organic and inorganic substance — both being in turn a manifestation of God) seems to have been responsible for these and similar errors. Material substances were assumed to be composed of ' body ' and ' spirit ' and just as ' spirit ' migrates from one human body to another in its different rebirths and thus attains final perfection, so, for the synthesis of the noble metals, it was thought necessary to go through successive stages and use substances containing

' spirits ' and ' souls ' of different degrees of perfection such as mercury, sal-ammoniac, arsenic sulphide, and sulphur. It may be recalled in this connection that as late as the third quarter of the 17th century JOHN MAYOW still used the word ' spirit ' in referring to the substance common to both air and nitre, which brought about combustion... »

« The appendix that follows the seventh chapter is entitled ' Experiment by testing and the use of proper quantities ' (or ' skilful manipulation '). The methods given in the 'Ain aṣ-ṣan'ah produce a homogenous substance of silvery appearance, whereas in the appendix the production of a white or yellow deposit on a metallic surface by an externally applied substance is described. »

A few illustrations representing chemical apparatus (aludel, oven, apparatus for carrying out the process of solution under dung, descensory, alembic, bain-marie) are reproduced from the Ms.

The Persian text covers 14 large pages, and is followed by the Arabic extract above-mentioned. The absence of a technical glossary is our only cause of complaint. It would have taken so little time to compile it, and so little space to publish it, and the usefulness of this edition for other students of mediaeval chemistry would have been materially increased.

GEORGE SARTON.

Benevenutus Grassus of Jerusalem. — *De oculis eorumque egritudinibus et curis*. Translated with notes and illustrations from the first printed edition, Ferrara, 1474 A.D. by CASEY A. WOOD. XIII + 101 p., 5 plates. Stanford University Press, 1929 ($ 5).

This is a very elegant publication which will probably reveal the existence of BENEVENUTUS and of his treatise not only to the « gens du monde » but to many physicians as well. It contains the first English translation of the text of the princeps (Ferrara, 1474), an introduction of 22 p., a bibliography, and 5 facsimiles.

It is relatively scholarly for an edition de luxe, but it can hardly be counted a contribution to knowledge. Of course it will be pleasant, even for scholars, to refer to this handy edition in their own tongue, but they did not really need it.

Furthermore, the author's investigation might have been more thorough. For example, I do not profess to have made a special study of BENEVENUTUS, and yet with no effort I can at once correct and increase the information given by the author. To the Mss. mentioned by him should be added at least two. A Latin Ms., perhaps anterior to 1400, in the public library of Hanover (quarto IV, 339), about which see KARL SUDHOFF, Ein neues Ms. des Ars nova (*Archiv für Geschichte der Medizin*, vol. 1, 384-85, 1908). Another Latin Ms. of the fifteenth century in the library of Besançon

(no. 475), studied by A. LAURANS (thesis, Montpellier 1903, 70 p.). This study is quoted by WOOD (on p. 101) but wrongly; he calls it « Le manuscrit de Jérusalem » (instead of Besançon). To the list of references I could add at once two or three important ones. GIULIO BERTONI : Sulle redazioni provenzale e francese della Practica oculorum di BENVENUTO (*Revue des langues romanes*, vol. 47, 442-51, Montpellier, 1904) and EDMUND O. VON LIPPMANN : Über Rübenzucker im Mittelalter (*Chemiker Zeitung*, 67, 1907); Abhandlungen und Vorträge (vol. 2, 255-57); Geschichte des Zuckers (2nd ed., 300, 1929).

If the author had really meant to increase our knowledge, he might have done one of two things, if not both. He might have made a critical comparison of the different texts of the *De oculis*, for these vary so considerably that one would think they represent the lecture notes of various pupils. Or, taking advantage of his own professional experience, he might have given us a study of this treatise from the ophthalmological point of view. He made no attempt whatever in either direction.

Though this is a very handsome little volume, its price (five dollars) is ridiculous if one considers that it is an edition de luxe in the fullest sense of the term, — an expensive superfluity. My criticism is perhaps wrong, because it is better for all concerned that the necessary and important publications be relatively cheap, and the unnecessary ones, expensive. The monographs of G. ALBERTOTTI, P. PANSIER, K. SUDHOFF, and others may be found in learned journals, and reprints of them were freely given by the authors to their friends. Books like this one, which appeal to bibliophiles and other maniacs, whose snobbishness has a scholarly tinge, must be expensive to be appreciated, and after all those people are just as satisfied with the appearance as with the reality of scholarship.

Thus I withdraw my criticism of the price of this book. It is not too dear for fools, and there are plenty of fools in the world, but poor scholars need not worry if they cannot afford it.

GEORGE SARTON.

Robert Theodore Gunther. — *Chaucer and Messahalla on the astrolabe.* Now printed in full for the first time with the original illustrations. VIII + 234 p., 73 fig. (*Early science in Oxford*, vol. 5) Oxford University Press, 1929 (two guineas).

« It is certainly remarkable that the oldest work written in English upon an elaborate scientific instrument should never have been printed in full. And when we remember that the instrument is one of the most important that the world has known, that the author was our greatest astronomer-poet, GEOFFREY CHAUCER, and that his works are very widely

studied, the neglect appears to be more than accidental : it is symptomatic of the attitude of the English mind to matters scientific. » This opening paragraph of the preface is startling enough, and needs no commentary. Whichever the guilt of the English people in general and of the Oxfordians in particular, it is now cleansed by GUNTHER's piety. To his many gifts, he has added this grateful one, which includes not only a full text of CHAUCER's astrolabe in modern English, but also the Latin text of MÂSHÂLLÂH *De compositione astrolobii* and *De operatione vel utilitate astrolabii* together with English versions of the same. Furthermore there is a facsimile reproduction in collotype of a Latin Ms. (Cambridge Univ. Lib., A. D. 1276) of MÂSHÂLLÂH's treatise; the facsimile is remarkably clear and legible.

As I spoke above of the full text of CHAUCER's astrolabe, I should add that that treatise remained unfinished. It was meant to be divided into five parts, of which only two were completed; of the three others (Book of astronomical and geographical tables; Description of the planets and their motions; The general rules of astrology) we only know the contents and a few extracts.

The first part was delightfully entitled Bread and milk for children; the second, The conclusions of the astrolabe, the use of the scales of the shadows. CHAUCER wrote this treatise in 1387, for his little son LEWIS, who was then ten years old. Apparently the English boys of that time had already some difficulty in reading Latin, and CHAUCER himself found it more pleasurable to use « naked words in Englissh ». Listen to the charming preamble :

« Little LEWIS my son, I have perceived well by certain signs thy ability to learn sciences touching numbers and proportions; and I also consider thy earnest prayer specially to learn the Treatise of the Astrolabe. Then forasmuch as a philosopher saith, ' he wrappeth him in his friend, who condescendeth to the rightful prayers of his friend ', therefore I have given thee an astrolabe for our horizon, composed for the latitude of Oxford, upon which, by means of this little treatise, I purpose to teach thee a certain number of conclusions appertaining to the same instrument. »

To make the description easier to comprehend, CHAUCER illustrated every chapter with a diagram; as many as sixty-two such explanatory figures may occur in the most complete Mss. These figures are printed in GUNTHER's edition for the first time (SKEAT had replaced them by sketches of his own devising).

Apropos of MÂSHÂLLÂH, whose treatise on the astrolabe was extremely popular and was CHAUCER's main source, he flourished in the second half of the eighth century. He was probably a Jew, but it is not at all

certain that his original name was MANASSEH (see my *Introduction*, vol. 1, 531; correction in *Isis*, 13, 150).

This volume is the fifth of the splendid collection entitled *Early science in Oxford*, the finest monument ever built by a single man to the scientific glories of old England. For the earlier volumes (1920-25), see *Isis*, 13, 118. GEORGE SARTON.

Lynn Thorndike. — *Science and thought in the fifteenth century*. Studies in the history of medicine and surgery, natural and mathematical science, philosophy and politics. XII + 387 p., 10 pl. New York, Columbia University Press, 1929 (4.75).

This book is what the French would call « matériaux pour l'histoire du XV^e^ siècle ». Materials for the study of the fifteenth century, — first hand and first class materials. Judging by the number of Mss. which the author has read or examined (for this and his earlier works) he must be able to do it with a relative ease, amounting to virtuosity. To be sure such ease grows as one's experience increases, and THORNDIKE's experience of libraries and their treasures is considerable, but as everybody knows experience is of little profit unless it be built up upon inborn ability. Without such ability, experience does never integrate itself; it remains disjointed, meaningless, and sterile.

To say with the author « It is hardly possible as yet to draw a general picture of the fifteenth century thought and science » is perhaps going a little too far, for we have already abundant and precise information on the fifteenth century mathematics, astronomy, chemistry, physics, anatomy, medicine, etc. In fact it would require not only ability and persistence but unusual luck to find a European text which would modify our knowledge of these subjects on any essential point. But there is undoubtedly much room for new and deeper investigations into the Mss. The truth is not that a satisfactory synthesis is as yet impossible, but that it has generally been attempted in the wrong way. Not only historians of the old type, but also historians of science have been constantly deluded by that beautiful word «Renaissance ». Of course, few are still crude enough to think of the Middle Ages as a nondescript period, whose main interest is to be between two really worthwhile ones, — a long period of dissolution followed by the glorious reawakening of the Renaissance, when mankind reassumed the ancient traditions, — a long period of darkness, followed by the miraculous dawn of the quattrocento. This oversimplified notion is now abandoned, yet even the more sophisticated are still under the spell of a beautiful name. The fact is that the Renaissance was not more a revival than any other period of the past, and that it was perhaps less so than the twelfth and thirteenth

centuries. As JOHN ADDINGTON SYMONDS had already said half a century ago « The Renaissance in general may be called the Middle Ages in dissolution ». This was far more true than SYMONDS could imagine, because his acquaintance with scientific and philosophic thought was but superficial. I have recently tried to show how very true it was. (1) When shall people finally get rid of the childish notion of comparing things which have no common measure? To say that this century is better than this other is pure foolishness. There are continual changes, which may be but are not necessarily nor always improvements; life is constantly flowing, unbuilding as well as upbuilding is going on, dissolution and reconstruction. Every age is a renaissance for some people, and the end of the world for others; every age is dull in some respects, and brilliant in others; every age is creative even when it destroys. But the one thing that we can say with confidence is that in spite of accidental cataclysms, knowledge is all the time accumulating, correcting and purifying itself. There may be periods of stagnation or even temporary backwardness, a nation may become inactive for a time, but the main drift is proceeding in the same direction : steady accumulation and purification of knowledge. It is for that very reason that the history of science is so tremendously interesting and should be the very backbone of historical studies. For example, I just said that it is impossible to make a quantitative comparison between different periods and to give the prize to this or that one. The activities of the fifteenth century were so different from those of the thirteenth century that we cannot say this or that one is better. But we can say this with confidence : The general level of knowledge attained by the intellectual leaders of the fifteenth century was higher than that attained by their ancestors of the thirteenth century : this does not prove that the former were more intelligent; they were simply standing upon the shoulders of their elders.

To return to THORNDIKE's book, as it is a collection of independent studies on a number of separate subjects, the best that I can do is to indicate its contents, adding a few remarks when necessary, or references to *Isis*. Indeed many of these studies had previously appeared in other journals, including *Isis*, but even in those cases, they are partly new because of the revisions and enlargements which they have undergone.

I. Introduction : The study of western science of the fourteenth and fifteenth centuries (*Isis*, 8, 543). This is a sort of transition between the present work and the author's earlier one, his History of magic and experimental science during the first thirteen centuries of our era (2 vols.,

(1) In my essay on Science in the Renaissance in a collective work *The Civilization of the Renaissance* (University of Chicago Press, 1929, 75-95).

1923; see *Isis*, 6, 74-89). The History of magic told the story down to about 1327. I hasten to add that the present work is not in any sense a continuation of the former. To begin with it does not attempt to tell a full story; it simply offers the materials which have been thus far worked out. On the other hand, it is immeasurably superior to the first work, by its better understanding of scientific problems. It is clear that the author has developed considerably in that respect during the last five years, and I trust, that if he had to rewrite today his History of magic, he would do it in a very different vein.

II. Medicine versus law at Florence (*Isis*, 9, 155). Apropos of a favorite subject of disputation in Florence, whether medicine is superior to law or not.

III. The manuscript text of the *Cirurgia* of LEONARD OF BERTIPAGLIA (*Isis*, 8, 264-84, 1926; 9, 506).

IV. A *Practica cirurgie* ascribed to JOHN BRACCIA of Milan or to PETER OF TOSSIGNANO. This takes us back to the fourteenth century. « The work is concerned with the practice of surgery, and is discussed here for the further reason that it so well complements the impressions which we have just received in the previous chapter from the writings of LEONARD OF BERTIPAGLIA as to the Italian surgery of the closing middle ages. » It is impossible to decide whether PETER OF TOSSIGNANO or JOHN BRACCIA of Milan was the author. At any rate that *Practica* was a valuable treatise containing genuine clinical notes some of which are quoted.

V. Some minor medical works written at Florence (*Isis*, 9, 29-43, 1927).

VI. A fifteenth-century autopsy. First hand account of an autopsy by BERNARD TORNIUS (1452-97), professor of medicine in Padua. « The bodies used in the university dissections were commonly those of executed criminals or other outcasts; the surgeons usually would treat only those cases where they thought that recovery was likely. In the present autopsy, on the other hand, we find a physician of note recommending, and a high official, presumably of good family, social standing, and considerable property, agreeing to a postmortem examination of the vital organs of the official's own son, with the aim to discover if the complaint of which he died was of hereditary character and so to prescribe more intelligently for the other children of the same father. »

VII. NICHOLAS OF CUSA and the triple motion of the earth. To bridge the gap which was supposed to exist between the Middle Ages and the Renaissance, two methods may be used. One may show that the mediaeval scientists were not as « mediaeval » in the conventional sense (i.e., were not as hopelessly backward) as is generally thought; or one may show that the « moderns » were not quite as modern. THORN-

DIKE uses both methods with equal skill. This essay is an application of the second. « Of the triple motion of the earth which HELLER and GERLAND credited CUSA with devising, there was no clear mention in the *De docta ignorantia*. Indeed, it is not contained in any of his works, but is briefly suggested in a note which he made upon one of the blank leaves of an astronomical, or rather, astrological manuscript that he purchased at Nürnberg in September, 1444. This brief note was printed in 1847 by CLEMENS in a footnote to his book on GIORDANO BRUNO and NICHOLAS OF CUSA, where it occupies barely a page. It is this humble jotting which has been elevated by the unbalanced and fantastic judgment of subsequent writers into an astronomical system marking the cleavage between the Ptolemaic and Copernican views and the beginning of modern astronomy. »

VIII. PEURBACH and REGIOMONTANUS : their great reputation re-examined. THORNDIKE claims that the importance of these two mathematicians has been exaggerated. I am not sure of that. I have been thinking of them, and of their contemporary mathematicians, off-and-on, for some twenty years, and my admiration for them is still increasing. However I prefer not discuss the question until I have reached that period in my *Introduction*, i.e., until I have all the facts of the fifteenth century mathematics neatly ordered in front of me. It is clear that it is only after such a comparative survey has been completed that the relative value of achievements can be appreciated.

IX. The arithmetic of JEHAN ADAM, A.D., 1475 (*Isis*, 9, 155).

X. NICCOLÒ DA FOLIGNO's treatises on ideas : a study of scholasticism and Platonism in the fifteenth century. This NICCOLÒ DA FOLIGNO (not to be confused with his younger namesake, the artist ALUNNO) citizen of Arezzo, was born in 1402 and died at Pisa in 1474. He apparently wrote two treatises on ideas, the one addressed to his compater NICCOLÒ, from Todi, in 1470, the other addressed later to LORENZO DE' MEDICI. The second is inferior to the former, but more in the humanist manner. The surprizing thing is that both treatises reveal a very poor knowledge of Platonism combined with much scholasticism. « It is a revelation to see so stiff a dose of scholasticism administered to the patron of the Platonic Academy, however gilded the pill may be with humanistic mannerisms. » « LORENZO DE' MEDICI was to have his attention again called to ARISTOTLE and the Platonic ideas by LORENZO BUONINCONTRI di San Miniato, the astrologer and poet, in the commentary to his poem on ' Things divine and natural ' ».

XI. Some Renaissance moralists and philosophers. Deals with four treatises of the second half of the fifteenth century; the *De cultu humanitatis et honestatis* by GREGORY CRISPUS of Toulouse; the *De humane vite felicitate*

dialogus by BARTHOLOMEW FAZIO (printed, 1473; Antwerp, 1556); the *De moribus* of JOHN NESIUS; the *De Deo et rerum naturalium principiis et summa beatitudine* by OLIVER OF SIENA.

« To sum up the total effect produced by the treatises which have been considered in this chapter, it has to be said that they display almost no new ideas or advance over the thirteenth century, that they are largely tiresome and insipid reading, sometimes affected. No pagan revival in morals or philosophy is manifested in them; there is merely a slight classical coloring in nonessentials. Classical allusions and citations are multiplied, but the Christian and Aristotelian points of view are intermingled much as in the preceding medieval period. We meet the same virtues as were personified in medieval allegory, drama, and art; we encounter such familiar themes as spontaneous generation and the orders of fallen angels. We fail to detect in our treatises any of that ' awakening of the human spirit ' which has been so often and so vaguely ascribed to an Italian Renaissance. »

XII. The *De constitutione mundi* of JOHN MICHAEL ALBERT of Carrara and its relation to similar treatises (*Isis*, 10, 141).

XIII. LIPPUS BRANDOLINUS *De comparatione reipublicae et regni*: a treatise in comparative political science (*Isis*, 10, 142).

This rich fare is followed by a number of appendices containing extracts from the Mss. discussed, tables of contents, and other complementary documents.

To discuss details in a book which is somewhat in the nature of a chrestomathy, would carry us too far, but there are two remarks which I cannot refrain from making. First THORNDIKE's reference (on p. 5) to syphilis implies that he considers SUDHOFF's thesis proved. It is not; of course the opposite thesis (American origin) is not proved either, but it is impossible to prove completely the negative proposition that syphilis did not exist in Europe before COLUMBUS's time. *Spirochaetae pallidae* may have originated in the old world, but if so, where are the clinical accounts of their doings before 1495? Syphilis is characterized by very neat symptoms; how is it that no ancient or mediaeval physician ever gave us an unmistakable description of them? Second, the author's definition of PETER DUBOIS, JEAN DE JANDUN, and MARSIGLIO OF PADUA, as royal jackals is an unfortunate lapse of urbanity. I can only account for it by supposing that the author was half asleep when he wrote that line, and that his pen was then guided by an evil spirit. These men were lawyers, but far better than the majority of them; in fact, they were very great men. Perhaps the author meant simply to stress the word royal? If he assumes all lawyers to be jackals, these were royal jackals indeed. However this interpretation would be even less pleasant

than the former, and it is more charitable to postulate a simple *lapsus calami*. The author meant to write jurist and he wrote jackal; the two words look so much alike that a palaeographer might easily confuse them.

Ten beautiful plates will give the reader an idea of the kind of raw materials out of which these studies have been distilled. As the field of such investigations is immense, let us hope that many more volumes of the same kind will follow this one. GEORGE SARTON.

Harry Austryn Wolfson. — CRESCAS' *Critique of* ARISTOTLE. Problems of ARISTOTLE's physics in Jewish and Arabic philosophy. XVI + 759 p. (Harvard Semitic series, vol. 6) Cambridge, Harvard University Press, 1929.

In form this is a critical edition of a part of CRESCAS' *Or Adonai*, together with an English translation and abundant notes. In reality, it is considerably more,—a historical and comparative study of some of the main problems of Aristotelian physics with special reference to the Arabic and Hebrew writings. If this book contained nothing more than a critical edition with translation and the usual notes, we would dispose of it with a few sentences, but it is in fact a deep investigation into Arabic and Jewish philosophy, which will help us better to understand mediaeval thought and mediaeval science.

But we must not anticipate, and as we have no right to assume that our audience is very familiar with CRESCAS, let us introduce him first. ḤASDAI BEN ABRAHAM CRESCAS was a Catalan Jew; born in Barcelona in 1340, after 1391 he flourished in Saragossa and died there in 1410. The *Or Adonai* (Light of the Lord), by far his most important work, was not completed until the end of his life. It is a large philosophical and theological treatise, divided into four books (ma'amarim), the first three of which are subdivided into parts (kelalim, summulae), which are again subdivided into chapters (peraqim) « The first twenty-five chapters of Part I of Book I are written in the form of proofs of the twenty-five propositions in which MAIMONIDES summed up the main principles of ARISTOTLE's philosophy. The first twenty chapters of Part II of Book I are written in the form of a criticism of twenty out of the twenty-five propositions. The present work deals with these two sets of chapters, with the proofs and the criticisms. Together they compose about one sixth of the entire work. »

These famous 25 propositions had been set forth by MAIMONIDES in his introduction to the second part of the *Moreh nebukim* (Guide of the perplexed). They soon attracted the attention of philosophers, and within the two centuries following their publication not less than

five commentaries were devoted to them, by AL-TABRÎZÎ, HILLEL BEN SAMUEL of Verona, ZERAḤIAH GRACIAN, JEDAIAH BEDERSI, and finally CRESCAS. But the latter was the first to make a thorough examination of them, and acting upon MAIMONIDES' own suggestion, to go back as much as he could to the ipsissima verba of ARISTOTLE and of his Greek and Arabic commentators.

I say as much as he could, for CRESCAS knew no Greek and probably but little (if any) Arabic. The sources of his thought are not always explicitly stated, but WOLFSON has ferretted them out, and the essential of his conclusions may be summed up as follows : CRESCAS knew ARISTOTLE only through Hebrew translations of Arabic translations. All these translations however were made with such extraordinary faithfulness that he had a very accurate knowledge of the Aristotelian writings. « He knew his ARISTOTLE as he knew his Bible and Talmud ». His Aristotelian knowledge was primarily derived from the intermediate commentaries (talkhîṣ) of IBN RUSHD, but it is probable that in certain cases at least the long commentaries (tafsîr) were also available to him. The Intermediate physics had been translated into Hebrew by ZERAḤIAH GRACIAN and by QALONYMUS BEN QALONYMUS; it is probable that CRESCAS used the second translation. His references to ALEXANDER OF APHRODISIAS, THEMISTIOS, and IBN BÂJJA were probably derived from IBN RUSHD. He made considerable use of the supercommentary of LEVI BEN GERSHON on the Intermediate physics. Another important source was the *Maqâṣid al-falâsifah* (Kawwanot ha-pilosofim) of AL-GHAZZÂLÎ, which had been translated into Hebrew more than once and was popular in Jewish circles. There has been considerable discussion as to whether CRESCAS knew the *Tahâfut al-falâsifah* of AL-GHAZZÂLÎ. It was assumed that he did because CRESCAS and AL-GHAZZÂLÎ had much in common, and many arguments of the *Or Adonai* can be found also in the *Tahâfut*. But this can be explained by their use of common sources, or by CRESCAS's use of the *Maqâṣid*. In short, there is no proof that he was acquainted with the *Tahâfut*, or with IBN RUSHD's refutation of it, the *Tahâfut al-tahâfut*.

CRESCAS's purpose « was to show that the Aristotelian explanation of the universe as outlined by MAIMONIDES in his propositions was false and that the proofs of the existence of God which they were supposed to establish were groundless. » Considering this destructive object, and CRESCAS' energy and ability in pursuing it, it is not surprizing that he incurred the enmity of the Jewish Aristotelians of the following century, especially the two brothers, JOSEPH and ISAAC BEN SHEM-ṬOB, and the former's son, SHEM-ṬOB BEN SHEM-ṬOB. It is a little more surprizing to find that he influenced some of the Christian opponents of ARISTOTLE,

such as FRANCESCO PICO DELLA MIRANDOLA (nephew of the more famous GIOVANNI PICO DELLA MIRANDOLA), and possibly GIORDANO BRUNO. Not that these men would have minded having much of their work cut out for them by the Jewish philosopher, but how did they know of it? FRANCESCO PICO was in all probability helped by a Jewish friend or secretary. Says WOLFSON (p. 34): « This confirms us in the belief that a great deal of Jewish philosophy was transmitted orally to non-Jews through the medium of Jewish assistants and that one must not confine the study of Jewish influence upon mediaeval philosohpy to Hebrew works which happened to have been translated into Latin. » CRESCAS' influence upon SPINOZA is easier to explain; it cannot be denied and is explicitly acknowledged by a reference of the latter to one « Judaeus quidam RAB GHASDAI vocatus ».

A great part of WOLFSON's work is devoted to a very thorough examination of the problems dealt with by CRESCAS with reference to the latter's sources, i.e., to a large part of Greek, Muslim, and Jewish philosophy. It is impossible to go into that, beyond stating that these problems center around the notions of infinity, space, vacuum, motion, time, matter and form; that is, they cover the whole ground of scientific philosophy. A final chapter entitled « Foreshadowing a new conception of the universe » is a sort of conclusion. Was CRESCAS' task purely destructive? His purpose certainly was, yet he could not help formulating his own tendencies. To quote the author (p. 127):

> « In a larger sense, we may see in CRESCAS' critique of ARISTOTLE the fluctuation of the human mind at the point when it began to realize that reason, which had once helped man to understand nature, to free himself from superstition and raise his desultory observations to some kind of unity and wholeness, had itself in the system of ARISTOTLE gone off into the wilds of speculation and built up an artificial structure entirely divorced from nature. A new way of returning to nature was sought, but none was as yet to be found. CRESCAS had passed the stage when man condemned reason; he had reached the stage when man began to doubt reason, but he had not yet entered upon that stage when man learned to control reason by facts. »

The method used by CRESCAS was the Talmudic hypothetico-deductive method of text interpretation, generally referred to as Talmudic quibbling or *pilpul*. WOLFSON's interpretation of *pilpul* (p. 25-27) is excellent, and it may help scholars who have not been brought up in a Talmudic atmosphere to have a better opinion of it, but when he concludes « *Pilpul* is nothing but the application of the scientific method to the study of texts », he confuses the truth in the worst manner. For the essence of the scientific method is precisely not to stop at words but to investigate as directly as possible the realities which these words are meant to re-

present, and to confront words with things not once, but as many times as may be necessary. From that point of view, ***pilpul*** is as antagonistic to scientific thinking as anything can be, and the slightest appearance of it in a scientific argument is sufficient to disqualify and discredit the speaker. As WOLFSON admits himself « In this method the starting point is the principle that any text that is deemed worthy of serious study must be assumed to have been written with such care and precision that every term, expression, generalization or exception is significant not so much for what it states as for what it implies », and a little further he compares the Talmudist's attitude toward the written word to that of the jurist toward the external phrasing of statutes and laws. Very good. But both attitudes, that of the Talmudist and that of the jurist, are diametrically opposed to that of the scientist. To begin with, the latter does not take any text as seriously as that, because he knows that the development of science is nothing but a series of progressive approximations. He acknowledges neither authorities nor precedents. « NEWTON said this »—« Well, that is interesting », he will answer; « NEWTON may be right, or he may be wrong. And even if he be right, his words may be wrong; or vice versa, his words may seem right and yet cover an idea which is wrong or incomplete. » He will not bother very much about that, because it is not so much NEWTON's words, not even his opinions, that matter, as the facts, as reality itself. Whether NEWTON was right or not is purely a question of historical curiosity, which is altogether ignored in the scientific argument. Even the historian of science, who differs from the scientist proper in that he is more genuinely interested in the past, will not attach any special weight to NEWTON's opinions as such. In fact he fully expects NEWTON to be wrong half of the time, and he is pleasantly surprized when he finds that some of his opinions are still considered true to-day. His admiration for NEWTON's genius is not based upon the absolute value of his discoveries, but upon their relative value at the time they were made.

A discussion of WOLFSON's edition and translation must be left to philologists. All I can say is that it offers all the external guarantees of excellence. But perhaps the most precious part of the work is the collection of notes which follow the text and fill more than half of the whole book (p. 319-700) These notes are hard to read consecutively, but elaborate indices will make it easy to refer to them. In fact, I foresee thatWOLFSON's book will hardly be read, but will be used as one would use a philosophical dictionary. The student of mediaeval philosophy will never consult it in vain, and each time he does so he will learn to pay a little more attention to Arabic and Hebrew sources. This will be in itself a great progress, which will be largely due to WOLFSON's

devotion. The Arabic glossary, and even more the Hebrew, will be of considerable use to editors of philosophical texts, and to the more scientific lexicographers. The very full index of passages quoted (Greek, Muslim, Jewish, Christian) will also be very useful in many ways. It includes references to Hebrew versions of the *Quaestiones physicarum* (*She'elot ṭibe'yot*) of JOANNES VERSOR, and of the *Philosophia pauperum* (*Qiẓẓur ha-filosofia ha-ṭibi'at*). By the way, the ascription of this last work to ALBERT THE GREAT is far from certain.

The book has been got up very handsomely, the many kinds of type being equally clear. The proofs were apparently read with considerable care; I noticed a few misprints here and there, e.g., dots missing in the transliterations, but this is almost unavoidable. The only serious mistake detected by me, was the spelling iḫwan for ikhwân (brethren), and that more than once! GEORGE SARTON.

Joseph H. Sinclair. — *The Conquest of Peru as recorded by a member of the Pizarro Expedition.* Reproduced from the copy of the Seville edition of 1534 in the New York Public Library. With a translation and annotations by JOSEPH H. SINCLAIR. 47 p., 2 maps. New York. The New York Public Library. 1929. ($ 3. —)

On the dark blue binding of the beautifully printed book under review is stamped — appropriately, in gold — a reduced reproduction of a woodcut familiar to historians of Peru and to bibliographers of Americana. It represents the Bible-throwing incident which marked the first meeting of the Dominican fray VICENTE DE VALVERDE with the usurper of the throne of the Incas, ATAHUALLPA, in Caxamarca, on November 16, 1532, and which was immediately followed by the capture of ATAHUALLPA and the killing of several thousand non-resisting Indians. Fray VICENTE and ATAHUALLPA met again, for the last time, on August 29, 1533, when the priest baptized the prisoner, thus conferring on him the privilege of being strangled, not burned alive.

The slaughter and conversion of the Indians, the expansion of the Spanish empire, and the pumping — via Spain — of the South American gold into Europe, were important concomitants and consequences of the conquest of Peru — from the points of view of the military, ecclesiastical, political, and economic history. Considered merely as a document from the epoch of the great discoveries, the anonymous *La conquista del Peru*, printed in Seville, by BARTHOLOMÉ PEREZ, in April 1534, is entitled to the attention of those who are interested in the history of civilization — especially in the destruction of civilizations.

The above mentioned woodcut appears on the title-page of another book printed in Seville, by the same BARTHOLOMÉ PEREZ, in July 1534,

— the *Verdadera relacion de la conquista del Peru*, by FRANCISCO DE XEREZ. The report of MIGUEL DE ESTETE on the anabasis to Pachacamac forms an integral part of the *Verdadera relacion*. Three months later, in October 1534, an anonymous Italian translation of the anonymous *La conquista del Peru* appeared in Venice, under the title LIBRO VLTIMO DEL SVMMARIO DELLE INDIE OCCIDENTALI. It was interpolated with more than two dozen excerpts from the reports of XEREZ and ESTETE. The LIBRO VLTIMO was reprinted in Rome, in May 1535. A French translation of it, by I. G., appeared in Paris, in February 1545, under the title: L'histoire de la TERRE NEVVE DV Perù en l'Inde Occidentale...; the curious map of Peru attached to the Paris edition will be discussed below. In PVRCHAS HIS PILGRIMES, London, 1625, appeared an abstract based on one of the Ramusio reprints (1556, 1565, 1606) of the LIBRO VLTIMO.

Sixteenth-century readers of the Italian and French interpolated versions of the anonymous *La conquista del Peru* must have enjoyed the descriptions of the caminos reales, the suspension bridges, the hot-and-cold-water city-wide canalization, the gold-plated temples, and the other wonders of Peruvian civilization; they must have shuddered at the thought of ATAHUALLPA's cup — made by a transatlantic contemporary of BENVENUTO CELLINI. The reader of the book under review will have to be satisfied with a less diversified selection of Peruviana.

An ideal Italian or French edition (appearing, e.g., in Venice, in 1934, or in Paris, in 1945) of *La conquista del Peru* will, probably, contain a diplomatic transcription of the blackletter Spanish text, facing a reprint of the corresponding XVIth-century translation; the original passages from the reports of XEREZ and ESTETE, used by the Italian interpolator, could be added below the Spanish text of the anonymous chronicle; facsimiles of the chronicle and of the title-pages, second titles, colophons, maps, etc. of the translations, reprints and bibliographically related documents would add to the value of the book for research and reference purposes; a bio-bibliographical introduction would untangle the maze of errors inaugurated four centuries ago in the search for the elusive identity of the anonymous author. PHILIP A. MEANS thinks (*Biblioteca Andina*, *Transactions of the Connecticut Academy*, v. 29, p. 362, New Haven, 1928) that ESTETE was the author of *La conquista del Peru* — ignoring the fact that the anonymous chronicler did not take part in the iconoclastic expedition to Pachacamac; HENRY STEVENS lists (*Rare Americana*, p. 79/80, London, 1927) the LIBRO VLTIMO as a work of XEREZ; the JOHN CARTER BROWN Library accepts (*Bibliotheca Americana*, *Catalogue*, v. 1, p. 142, Providence, 1919), without reserves, OVIEDO as the author of L'histoire de la TERRE NEVVE DV Perù. An ideal

edition of an anonymous work ascribed to several authors ought, of course, to investigate the validity of such claims. But let us return from the ideal editions of the future to the beautifully printed book which is before us.

It consists of an introduction (p. 3), a facsimile reproduction of the eight unnumbered leaves of the anonymous original (p. 5-20, unnumbered) an annotated English translation (p. 21-43), a bibliography (p. 45-47), and two maps.

The facsimile of the Spanish text is, of course, the most important part of the book. Unfortunately it has been tampered with — and the reader is not even told that faintly printed or broken letters have been « restored ». Thus, « *prometio* » became « *premetio* » (fol. 7, recto), « *quanto* » became « *euante* » (fol. 7, verso), etc. The documentary value of a misleading facsimile is zero, if the existence of the facsimile may be safely disregarded; the value becomes negative, if the facsimile is likely to be used for research purposes.

There are two well reproduced maps. One of them will be found very useful by the reader of the English translation, although some details of the line of march of the conquistadores, as indicated by the compiler, Joseph H. Sinclair, differ from the routes traced by other investigators; the scale of the map bears no simple relation to inches or centimetres — a result, apparently, of an ulterior adjustment of its size to the size of the book, of which it forms the frontispiece.

The other map is a reproduction of the very interesting French map of the 1545 edition. It is facing p. 46, where the bibliographical references to L'histoire de la TERRE NEVVE DV Perù begin; although considerably reduced, it is still quite legible; unfortunately, J. H. Sinclair fails to state that his reproduction of this important document is made from the remarkable facsimile in the N.Y.P.L., and not from the only known original copy in the Bibliothèque Nationale. His statement that the map in the N.Y.P.L. is a « photographic copy » is wrong, since it is a pen-and-ink drawing, apparently one of the masterpieces of J. Harris the elder. We shall see, in commenting on J. H. Sinclair's bibliography, that his acquaintance with the French edition of 1545 — although he devotes almost a full page to the book and to the map — is very superficial.

If we disregard the short abstract, in PURCHAS his PILGRIMES, based on Ramusio's reprint of the interpolated LIBRO VLTIMO, the English translation by J. H. Sinclair makes the anonymous chronicle for the first time accessible to the general reader familiar with English but not with XVIth-century Spanish, Italian or French. It was no easy task to translate into modern English the anonymous Spanish chronicle; even the Italian translator who had the double advantage of writing

in a closely related Romance language, and of giving a relatively free version of a contemporary document, was not always successful in rendering difficult passages of the anonymous chronicle. In spite of the defects of the Italian version, a modern translator of *La conquista del Peru* could lose little and gain much by reading the LIBRO VLTIMO — or even L'histoire de la TERRE NEVVE DV Perù. Unfortunately, J. H. SINCLAIR's acquaintance with these two interpolated translations appears to be very superficial; thus, he thinks that the LIBRO VLTIMO « translates all of our " La Conquista del Peru " with some additional matter about the arrival in " Sibilia " (Seville) on January 15, 1534, » without being aware of the fact that « some additional matter » from various sources can be found not only at the end, but also at the beginning of the LIBRO VLTIMO, and that about one-quarter of the book is made up of the two dozen passages borrowed from the reports of XEREZ and ESTETE; as for J. H. SINCLAIR's familiarity with the Paris, 1545 edition, — and with XVIth-century French in general, — we shall have to discuss these matters speaking of his three pages of bibliography. That the translator was sometimes careless about his black-letter Spanish original, is illustrated by the following three samples of slip-shod reading.

Exhibit A (p. 37): « ... and who arrived there after much trouble because they had decided not to bring any horses at all on account of the lack of grass and on account of the bad roads. But Hernando Pizarro ordered the Indians to make shoes and nails of gold and silver and so they brought their horses to the town where the temple was situated. » The Spanish text (fol. 5, verso) has « ***herrage*** » — not « ***herbage*** », — followed, in the next line, by « ***herraduras d'oro y de plata y clauos*** ». The context makes the non-detection of the misreading almost impossible. A philologically minded translator might even have commented on the involuntary *jeu de mots* of the Spanish chronicler, which is lost in the English translation, and might have illustrated the point by expressions like « un fer à cheval en or », or « ein goldenes Hufeisen ».

Exhibit B (p. 30): « Then Hernando Pizarro who had remained in the background to place three or four horsemen at a gate where there was a bad passage... » The Spanish original (fol. 3, verso) has « ***vn puerto dõde auia mal passo*** » — not « ***vna puerta*** ». The translator mistook a mountain pass for a gate, and his linguistic feelings were not hurt by the hybrid « ***vn puerta*** ».

Exhibit C (p. 38): « When he was there, Chiliachimac who was the Captain who made Cuzco prisoner sent to him... ». In the Spanish text (fol. 5, verso) a parenthesis follows the name « ***Chiliachima*** », introducing this dramatis persona. To mistake the opening parenthesis « (» for the letter « c » is a double carelessness, because they differ in

size and shape, and because the closing parenthesis «) » after the name « *Cuzquo* » must have been overlooked or dismissed as some meaningless sign. To make matters worse, J. H. SINCLAIR added a footnote to his « Chiliachimac », which reads as follows : « " Chilicuchima ", says Xerez. Markham corrects it to Chalcuchima. » This footnote, with the name ending twice in « ma », not in « mac », might have suggested to the translator that his reading needed revision; the inconsistent use of the quotation mark in the footnote is characteristic of the man who is responsible for the bibliography discussed below.

There are 52 footnotes to the translation which are referred to as « annotations » on the title-page. The first page of the translation has 14 footnotes, the next three pages have 6 footnotes each; the remaining 52 — 32 = 20, including one cross-reference, are distributed over the remaining 15 pages. The footnotes are useful for readers of the translation who are not familiar with Peruvian places and people.

We now come to the three pages entitled « Bibliography ». They will remain for many years to come a silent, yet eloquent warning for people who are disqualified by their temperament and training, to keep away from bibliographical work. Of course, there are more important things in life than the spelling of Italian or French words, capitalization, punctuation, hyphenation, etc. FRANCISCO PIZARRO conquered an empire — yet he was completely illiterate. Those who are compiling bibliographies dealing with his conquests must humbly pay attention to the vagaries of XVIth-century spelling and other minutiae.

The 5 (five) lines, on p. 47, which are the result of a pathetic attempt on the part of the bibliographer to give a diplomatic transcription of the left-hand title of the 1545 map facing p. 46, contain no less than 14 (fourteen) misreadings detected by the reviewer without the aid of a magnifying glass; among them are : « sousz » for « *soubz* », « dessous » for « *dessoubz* », « congnoise » for « *congnoisse* », « l'amerique » for « *l'Amerique* », « posible » for « *possible* », « une portraict » for « *ung portraict* », etc.

The interminable rows, with vertical bars, of beautifully printed titles quoted in full are bibliographically worthless, because the use of type, hyphens, capitals, etc. is as inconsistent as the spelling is careless. J. H. SINCLAIR writes NATVRALE ET GENERALE HISTO | RIA for NATVRALE ET GENERAL HITSO | ria; GONZALO FERDI | NANDO DEL'OUIEDO, ALTRIMENTE DI VALDE for Gonzalo ferdi = | nando del Ouiedo, altrimenti di valde; LATERRA for la terra; NAGUERE for nagueres; Books for *BOOKES* — to quote but a few of his many bibliographical blunders.

Speaking of L'histoire de la TERRE NEVVE DV Perù, he mentions (p. 47) that « the translation of the " La Conquista del Peru " begins

on the verso of leaf BII.» When he was looking at the signature Bij, he paid, apparently, no attention to the two-line note, in italics, inserted just above the signature; it informs us that «*L'aucteur est Gonzalo Ferdinãdo del Ouiedo natif de Madril, q(ui) a faict l'histoire generale, dõt est extraict ce summaire*». This note contradicts the correct statement in the immediately preceding lines of the text which informs us that the anonymous chronicle was written «de la main decelluy qui y fut present.» The two-line note was obviously the result of an unfortunate afterthought of the Parisian editor or printer who mistook the anonymous LIBRO VLTIMO for a direct continuation (incipit: Si come nelli precedenti libri s'è veduto chiaramente...) of the LIBRO SECONDO, the second title of which contains the correct information that it is a translation of the SVMMARIO written by «Gonzalo ferdinando del Ouiedo... natio de la terra di Madril.» Only bibliographical shortsightedness can put on José Toribio Medina the blame for the ascription of the authorship of the anonymous chronicle to Oviedo — the error was commited almost four centuries ago. But, of course, J. H. Sinclair did not know it.

One more sample of careless bibliography. Ramusio reprinted — with numerous minor changes — the LIBRO VLTIMO, under the title RELATIONE DI VN CAPITANO Spagnuolo della conquista del Peru. There is a period at the end of the title. Ramusio subdivided the report into eleven chapters, headed by eleven titles printed in italics; six of them begin with the characterictic word *Come*. The first of these chapter-titles follows, of course, the above mentioned general title. With his usual disregard for punctuation, capitalization, type, paragraphing, etc., J. H. Sinclair ascribes (p. 47) to Ramusio's reprint the absurd five-line title beginning thus: «Relatione di Vn Capitano Spagnuolo della conquista del Peru come il Signor Francesco Pizarro...»

There still remains the one-page «Introduction». It does not even mention the fact that the authorship of the anonymous chronicle has been ascribed to Xerez and to Estete (we have seen how the erroneous ascription of the authorship to Oviedo is referred to in the «Bibliography»).

Though the «Introduction» is very short, it is not without its share of errors. Xerez gives the following dates for the arrival in Seville of the first four ships with the Peruvian plunder on board: December 5, 1533, January 9, 1534 (*Santa Maria del Campo*). and June 3 for the last two ships. J. H. Sinclair ascribes to Xerez the following dates: Dec. 5, 1533, Jan. 8, June 3, and June 4, 1534.

The very first statement of the «Introduction», that the document he is editing is «one of the two known copies», is characteristic of J. H. Sinclair's attitude to his work. He should have told us where the

other known copy is. It is in the British Museum (G. 6589); the difficulty of finding the anonymous chronicle in the *Catalogue* (it is listed under PIZARRO, FRANCISCO) has led modern bibliographers to statements denying its existence; the HEBER-GRENVILLE copy was known to XIXth-century bibliographers long before N.Y.P.L. copy came to challenge its claim to uniqueness.

There still remains some hope that one of the three libraries — the N.Y.P.L., the JOHN CARTER BROWN Library, and the British Museum — treasuring the surviving copies of the companion volume to *La conquista del Peru*, the 1534 edition of the *Verdadera relacion de la conquista del Peru*, by XEREZ, will publish a modern edition with an introduction and a bibliography superseding the corresponding parts of the book under review. There is no satisfactory modern reprint based on the 1534 edition of XEREZ. HORACIO H. URTEAGA neglected to indicate the sources of his Lima, 1917 edition; he used the Madrid, 1891 reprint of very dubious pedigree, and made things worse by replacing the XEREZ version of ESTETE's report by the OVIEDO version of it (Madrid, 1855). An entirely different report by ESTETE, from the Simancas archives, was published in the meantime by CARLOS M. LARREA (Quito, 1918), and reprinted by H. H. URTEAGA (Lima, 1924). Now that PHILIP A. MEANS claims for ESTETE the authorship of the anonymous chronicle, it is about time to publish a critical edition of XEREZ, of the three versions of ESTETE's report, and of *La conquista del Peru*.

ALEXANDER POGO.

J. J. Fahie. — *Memorials of Galileo Galilei*, 1564-1642. Portraits and paintings, medals and medallions, busts and statues, monuments and mural inscriptions. With 20 portraits and 42 other illustrations. XXIV + 172 p. Printed for the author: Leamington, Courier Press, September, 1929 (200 copies only printed, of which 105 are for sale).

This model iconographical study is a very useful complement to the author's excellent biography of GALILEO (London, 1903). Though published twenty-five years ago that biography is still the standard work in English. FAHIE's new work realizes the project which the great GALILEO scholar, ANTONIO FAVARO (1849-1922), had undertaken in 1913, but which he did not live to complete. By the way a biography of him, with portrait, appeared in *Isis*, vol. 7, 456-67, 1925.

One may say that no finer monument has ever been erected to a man of genius than the national edition of GALILEO's works prepared by FAVARO (20 large vols., 1890-1909). And outside of that edition FAVARO had devoted some 500 separate studies to the great master. Will the

English speaking people ever produce a scholar of FAVARO's intelligence, energy, and devotion who would edit NEWTON's works and letters, and investigate his life, with the same thoroughness?

Perhaps the best compliment that can be made of FAHIE's work is that it is worthy to be placed on the same shelf as FAVARO's splendid edition.

It is beautifully illustrated, and each separate portrait, whether reproduced or not, is discussed in detail, all necessary information on the painter, owner, etc., being given simply and clearly. Most people remember GALILEO's face only through the portraits of JUSTUS SUSTERMANS or their copies. The description and discussion of these particular portraits covers 18 p. (32-50): the earliest was made in 1635 when GALILEO was 71, the last 5 years later. Thus most people remember GALILEO only as an old man. A most interesting portrait, new to me, is the one by DOMENICO TINTORETTO (pl. 2) representing a younger GALILEO (aet. 42). The author was able to trace it to England, in the collection of Mr. G. H. GABB of Hampstead, who bought it in 1919 « in a speculative spirit. » It shows very well two curious characteristics of GALILEO's face, a kind of wart on the left cheek and a strong dissymmetry between the two eyes (this is seen even better in the two portraits by OTTAVIO LEONI, pls. 5 and 6).

A good instance of the intricacy of some iconographical problems is the one afforded by the painting of MILTON visiting NEWTON by ANNIBALE GATTI (c. 1877). Says the author (p. 97): « This painting, apart from its great merit as a work of art, beats the record, I think, for replicas, i.e., copies by the artist himself. A short time before GATTI's death in 1893, Professor FAVARO was privileged to visit his studio in Florence, and found him at work on a new edition, the fourteenth or fifteenth (the artist could not be certain), and hardly two of them alike, each copy being made to suit the taste of the customer. » The same subject tempted another Italian artist, TITO LESSI, in 1893 (p. 101): « This is a smaller and less ambitious production than GATTI's on the same subject, but it is more true to reality, and also to history, in that the scene is laid in GALILEO's last home in Arcetri, and, probably, in the very chamber in which the meeting took place in 1638. »

In spite of FAVARO's and FAHIE's patient investigations, a number of iconographical problems remain unsolved (see, e.g., p. 86, 103) and the reader's collaboration is invited to bring a later edition of this work nearer to perfection. G. S.

Arnold Buffum Chace, Ludlow Bull, Henry Parker Manning, and Raymond Clare Archibald. — *The Rhind mathematical*

papyrus. British Museum 10057 and 10058. 2 vols. Vol. 1, royal octavo, 28.5 × 20.5 cm.; 10 + 210 p.; Vol. 2, oblong folio, 28.5 × 36 cm., 288 p. Oberlin, Ohio, Mathematical Association of America, 1927-1929.

Those who have been awaiting this publication for a long time will not be disappointed when they finally receive it. It is splendid in every respect. Up-to-now, the Rhind mathematical papyrus had been published thrice: (1) by A. EISENLOHR (Leipzig, 1877 ; partial reprint, 1891); (2) by the British Museum (London, 1898),; (3) by T. E. PEET (London, 1923). The second of these publications, entitled *Facsimile of the Rhind mathematical papyrus*, was in reality a facsimile of an imperfect hand copy of the original. The first was based on the same hand copy. PEET's edition was the first directly based upon the original; it superseded the two earlier ones which contained many errors. See my review of it in *Isis* (6, 555-57), wherein I discussed the papyrus itself; much of that discussion would apply as well to the new edition, but I shall not repeat what I have said.

PEET's edition contained a hieroglyphic transcription of the Rhind papyrus and a free English translation; it included the fragments belonging to the New York Historical Society. The new edition, which may be called CHACE's edition, is the first to give a complete photograph of the whole papyrus; it also includes a complete transcription in hieratic, a transcription in hieroglyphic, English translations, literal and free, a commentary, an exhaustive bibliography, and many other good things, as we shall see presently.

It is perhaps best to begin our review with a formal description of both volumes.

Vol. 1 which was already printed in 1927, but was withheld until the second was completed, contains a mathematical discussion of the papyrus by Chancellor CHACE and H. P. MANNING (p. 3-47), divided as follows: Egyptian arithmetic; Egyptian measures; Egyptian geometry; The methods and aims of the Egyptian mathematician; Note on the Egyptian calendar and Egyptian chronology; Note about words for grain and other kinds of food. Then follow the free translation and commentary (p. 49-119); and the bibliography (p. 121-206).

Vol. 2 (1929) contains by way of introduction, a summary of Egyptian writing and grammar which will be very valuable to non-Egyptologists (i.e., to the great majority of readers) because of its concision and clarity. Then comes the photograph of the papyrus—5/6 of original size—on 31 plates. Notice pl. 9, showing all of about 40 fragments in the New York Historical Society, appropriately placed. Then on 109 plates, a faithful transcription of the original hieratic (collated with photographs

of the papyrus), hieroglyphic transcription, transliteration of the hieroglyphs, sign by sign, as they occur. On the opposite pages are given a transliteration written from left to right and an English literal translation. The papyrus is written mainly in black, the most important words and figures being in red. The red parts of the original hieratic are printed also in red in the four following stages : hieroglyphic, its transliteration, transliteration reversed, literal English. Thus it will be easy enough for any intelligent reader to go backwards from the passage interesting him in the free English version down to the original hieratic. In fact, I believe that irrespective of its mathematical interest, CHACE's edition will be an excellent manual for young Egyptologists.

At the end of vol. 2 will be found three supplements : (1) to the bibliography (22 more pages); (2) a note on The mathematical leather roll in the British Museum, by S. R. K. GLANVILLE, with a photograph of it. A more elaborate study of the same text by the same scholar appeared in the *Journal of Egyptian archaeology* (vol. 13, 232-38, pl. 58-62, 1927); (3) addenda and errata.

Let us now examine a few parts more carefully. The first question I ask myself when I approach a memoir on Egyptian science, is this : « What is the author's general conception of it? Does he consider it mere empiricism or legitimate science? » This is what Chancellor CHACE has to say on this subject :

« The author of this papyrus had an idea of general methods applicable to groups of problems, and within the groups simple problems are followed by more complicated ones that are of the same kind and are solved by the same methods. The methods of the Egyptian were largely those of trial and what we might call approximation. That is, if he could not get the answer at once he would try to get nearly the answer first and then make up what was lacking. This appears especially in what we have called the second kind of multiplication, where he has the multiplicand and product given to find the multiplier, while the method of false position is also a method of trial. Yet he was quick to generalize and when he had found a solution for a simple problem he did not hesitate to solve in the same way more difficult problems of the same kind, and occasionally to state the solution as a rule. He expresses this idea at the end of Problem 66, where he says, ' Do the same thing in any example like this. ' Some processes are repeated again and again, showing that he had a method clearly in mind, even if he did not express it as a rule. » (See also p. 40-42).

This is clear enough, I think. The Egyptian mathematician had a method, or methods. And who speaks of method, does he not speak of science? However, such discussions may be continued indefinitely, for it is largely a matter of appreciation; where exactly do method and science begin?

Chancellor CHACE suggests that the Egyptian mathematicians may

possibly have compiled tables (as we know the Babylonians did) which would have considerably expedited their accounts. This is I believe a very plausible suggestion, the more so because all the mathematical computations (which must have been abundant in a country as civilized as ancient Egypt) were probably intrusted to a relatively small group of men. These were bound to become experts, and to feel the need of short-cuts, such as the tables would provide.

These mathematicians made mistakes, who does not? « Almost any modern mathematical book, in spite of the careful proof-reading that it receives, contains mistakes just like those in the papyrus, and some of them contain many more than the papyrus. The remarkable thing is not that there are mistakes, but that most of the calculations are carried through without them. »

We may expect a bibliography compiled by R. C. ARCHIBALD, to be as nearly perfect as human patience and ingenuity can make it, and our expectation is fulfilled. The titles are fully given and followed by critical notes, some of which are very extended. There are only two eighteenth century studies, the first, by H. GRAM : *De origine geometriae apud Aegyptios* (44 p., Copenhagen, 1706); the second, strangely enough, by ISAAC NEWTON : *A dissertation upon the sacred cubit of the Jews and the cubits of the several nations*, etc. (printed posthumously in 1737). My only criticism of this bibliography is that in my opinion, being as elaborate as it is, the authors' names ought to have been quoted in full. Not GRAM, H., but GRAM, HANS. In my own publications I try to give the names in full, because this eliminates some errors; the letters E and F may easily be confused, but not the words Ernst and Franz. Furthermore, the same word may be represented by more than one initial, e.g., William by W. or G.; John by J. or I., etc. But this is a small criticism. The bibliography is followed by the necessary indices and by a « Chronological list of documents discussed » whose length astonished me. No less than 47 documents are quoted in the list of 1927, plus 16 in the supplement. They range from 3500 B.C., the Hierakonopolis mace of Oxford, to 1000 A.D., a palimpsest in demotic and Greek; they thus represent an evolution of four and a half millennia !

It should be noted that though specifically devoted to Egyptian mathematics, this bibliography—(the main part and even more so its supplement)—contains abundant information on Babylonian mathematics. Students of Babylonian science are advised to refer to it.

I was very glad to hear that the Golenishchev mathematical papyrus of the Moscow Museum of Fine Arts (of c. 1850 B.C. and apparently copied from an older work) of which V. V. STRUVE had been preparing

an edition for a long time, will appear within the year 1930. I look forward to its publication.

This excellent work is also a very beautiful one. I am generally hostile to editions de luxe and inclined to judge them with exceptional severity. It happens but too often that such an edition is nothing but a means of imposing upon innocent readers, and beguiling them. This is certainly not the case for the work under review. It is a fundamental contribution to a great subject. Think what it stands for : a mathematical treatise written thirty-six centuries ago and copied from a text two centuries older still. Can too much honor be paid to such a venerable document ! Many people think of EUCLID as the fountain head of mathematics, but there is the same interval of time between the original author and EUCLID as between CHRIST and COLUMBUS !

I am generally hostile to editions de luxe because either they are nothing but bluff, or if intrinsically valuable they are hopelessly beyond the reach of scholars. It must be our purpose to distribute available publications in the best manner, to make sure that they reach the people who can appreciate them and no others. As most scholars are poor, and most amateurs of editions de luxe but half educated, it is clear that these editions—if truly learned—can hardly reach their legitimate owners. But to this one may answer in the first place, that some publications are unavoidably expensive (it is only the avoidable luxury which is wicked), and that thanks to Chancellor CHACE's generosity this work is sold at a very moderate price, and in fact, below cost, to the members of the Mathematical Association of America. I may add that the proceeds of its sale was donated by him to that Association, to constitute a special endowement of it.

One more word. This publication does special honor to one of the oldest American colleges, Brown University of Providence, in the state of Rhode Island. Indeed the promoter, donator, and main author, Dr. CHASE, has been many years its Chancellor, and two other authors, MANNING and ARCHIBALD, are professors in its mathematical department. The fourth author, LUDLOW BULL, is attached to the Egyptian department of the Metropolitan Museum in New York (see *Isis*, 7, 262).

GEORGE SARTON.

Franz Hübotter. — ***Die chinesische Medizin zu Beginn des XX. Jahrhunderts und ihr historischer Entwicklungsgang.*** Verlag der Asia major (Dr. BRUNO SCHINDLER) Leipzig, 1929. (1) 356 p. quarto, mimeo-

(1) There is also a Chinese title reading Chung hua i hsüeh (2875, 5005, 5380, 4839).

graphed from a typewritten copy, with many drawings in the texts. Price, paper covers RM 50, bound RM 56.

The author of this important memoir on Chinese medicine, was unusually well qualified to write it. He began his study of the subject more than 15 years ago, and though frequently interrupted by his professional duties (chiefly during the war), he resumed it time after time with remarkable persistence. He spent many years in Japan as well as in China, was able to take advantage of the labor of Japanese scholars (such as Y. FUJIKAWA and K. DOHI), and what matters even more, to study Chinese medicine as it is still practised to this day in both countries. He need hardly be introduced to our readers, for his writings have often been discussed in *Isis*. Here is a list of those which have been dealt with, references to *Isis* being added, when this seemed worthwhile.

1. Berühmte chinesische Ärzte (*Archiv für Geschichte der Medizin*, vol. 7, 115-28, 1913).

2. Shou Shi-pien. Ein chinesisches Lehrbuch der Geburtshilfe. Aus dem chinesischen Urtext übersetzt und erläutert (94 p. autographiert; Berlin, URBAN und SCHWARZENBERG, 1913).

3. Beiträge zur Kenntnis der chinesischen sowie der tibetisch-mongolischen Pharmakologie (324 p. autographiert, Berlin, ibidem, 1913).

4. 3000 Jahre Medizin. Ein geschichtlicher Grundriss usw. (525 p. autographiert, Berlin, ROTHACKER, 1920). See *Isis*, 4, 369-70.

5. A guide through the labyrinth of Chinese medical writers and medical writings (74 p. mimeographed, Kumamoto, 1924). See *Isis*, 7, 259.

6. Zwei berühmte chinesische Ärzte des Altertums, CHOUEN YU-I and HOA T'OUO. 2. Auflage (48 p., Tokyo, 1927). See *Isis*, 10, 236.

7. Zwei tibetische Textfragmente medizinischen Inhalts aus Turfan. Festschrift MAX NEUBURGER gewidmet (188-91, Wien, 1928).

8. New edition of the Biographisches Lexicon der hervorragenden Ärzte, to be reviewed in *Isis*.

(If this list is not complete, especially with regard to Asiatic medicine, the author will do us a favor by enabling us to complete it).

To return to the new work, I shall begin by analyzing it, but as the author's transcription of Chinese words is sometimes erratic, I shall disregard it and replace it throughout this review by the transcription which is standard in my *Introduction* and in *Isis*, that is, the transcription given in the *Chinese-English dictionary* of HERBERT A. GILES (second edition, 1912). Each Chinese word is followed by the number corresponding to it in GILES's dictionary. The phonetic value of GILES's transcription does not concern us, but the numbers represent the original Chinese characters without ambiguity.

The author begins by giving us a bibliography of the subject. The

catalogue of western publications is naturally very short; the Chinese sources are indicated in the form of a list of physicians and their works. That list is substantially identical with the one which the author published in English during his stay in Japan (Kumamoto, 1924; *Isis*, 7, 259). Among the newer sources I may mention the ***Chung-kuo-i-hsüeh-shih*** (2875, 6609, 5380, 4839, 9893), published by CHÊN PANG-HSIEN (643, 8648, 4513) in Shanghai, 1920.

The explorations across Central Asia which have yielded so many archaeological treasures have thus far been unproductive from the point of view of the medical historian. It seems more and more plausible to admit the fundamental originality of Chinese medicine at any rate during the pre-Buddhist period. On the other hand the respiratory exercises which obtained so much importance among Taoists were probably of Buddhist, i.e., of Hindu origin (1). The ancient Chinese medicine was essentially pneumatic like that of the ancient Egyptians, in contradistinction to Mesopotamian medicine and Greek medicine which were essentially humoral (p. 41).

The account of Chinese anatomy begins with embryology, followed by osteology and myology. There is no Chinese osteology in the western sense; that is, there are no accurate descriptions or representations of individual bones. With few exceptions, Chinese anatomical names do not refer to definite bones but to parts of the ossature which can be seen from the outside. E.g., the bones of the skull are not differentiated, but there are names for the coronal, the orbit, the cheek bone, etc. They count 21 vertebrae. The viscera are divided into two main groups: the *tsang* (11584), i.e., liver, lung, heart, spleen, kidneys, and the *fu* (3685), i.e., stomach, intestines, bladder, gallbladder, and the *san chiao* (9552, 1323). These two groups are essentially different; in fact, they are opposites, for the *tsang* correspond to the female principle *yin* (13224), and the *fu* to the male principle *yang* (12883). We recognize already the love of symmetrical and arbitrary classifications which dominates and sterilizes Chinese thought. For example, all sorts of correspondences are established between the five *tsang* organs, the five directions (cardinal points and center), the seasons, the elements, the colors, the tastes, the intellectual faculties (2). After these general considerations, the author considers some organs in greater detail: eye, ear, lung, large intestine, stomach, spleen, pericardium, heart, small intestine, bladder,

(1) On similar exercises practised in India to-day see VASANT G. RELE (Bombay, 1927; *Isis*, 11, 224).

(2) For other examples of the same characteristic aberration see LEOPOLD DE SAUSSURE: La cosmologie chinoise à propos du nouveau drapeau chinois (*Isis*, 5, 140-42).

kidneys, liver, and the *san chiao* (9552, 1323). The latter are three imaginary passages (p. 55). It is not worth while to describe or discuss these *chiao*; the illustration which I am reproducing (fig. 1) will suffice; it shows the upper, middle, and inferior *chiao* on both sides of the body.

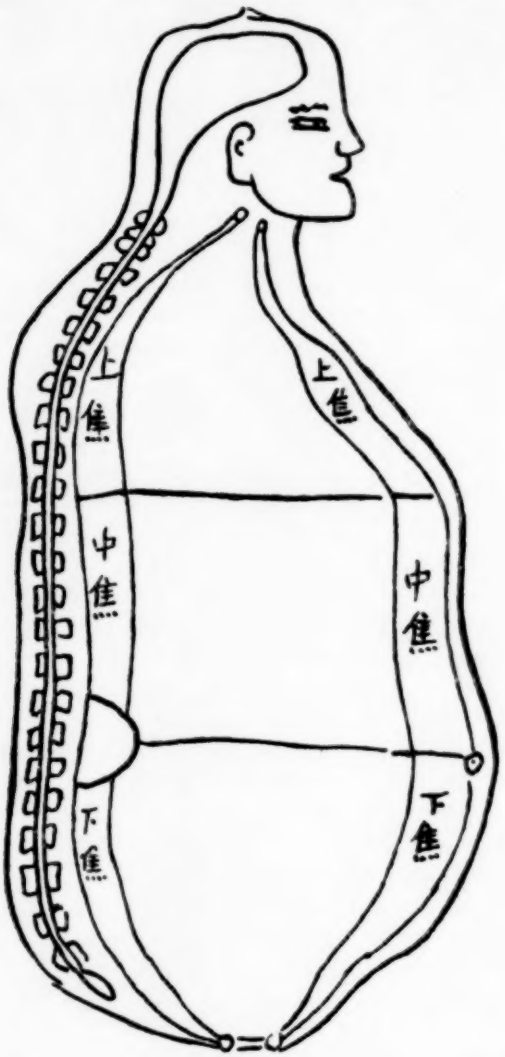


FIG. 1

The main difference between man and woman consists in the germ glands which are in the *ming mên* (7962, 7751), the « door of life » located

in the right kidney (according to HÜBOTTER; according to GILES, it is located between the two kidneys). The *ming mên* of a man correspond to fire, heaven, and *yang*; that of a woman to water, earth, and *yin*. The animal spirits, *shên* (9819) are located in the heart; the mind or soul, *hun* (5244), in the liver; the anima vegetativa, *p'o* (9420), in the lung.

Chinese physiology is explained by means of extracts from the medical classics, mainly the Questions of the Yellow Emperor, *Huang Ti Nei-ching* (5124, 10942, 8177, 2122) and the *Ling-ch'u-ching* (7222, 10092, 2122). Physiological applications of the doctrine of changes, *I-ching* (5497, 2122), are extracted from a commentary by CHU TAN-CH'I (2544, 10618, 1009), who died in 1358. We find in it, e.g., a complete medical elaboration of the eight trigrams, *pa kua* (8504, 6311), and many other things of the same kind, equally ingenious and senseless. All this is so magical from the western standpoint, that it is difficult to see where the *i-ching* ends and the real magic, *wu* (12735) begins. Whichever the case, their excessive fondness for symmetrical analogies have induced the Chinese to develop a very elaborate theory comparable to the western correspondence between microscomos and macrocosmos, and yet in all probability independent of it.

The same fantastic theorization is continued in their general pathology. A number of short chapters are devoted to special diseases and to special branches of medicine, such as dentistry, obstetrics, gynaecology, pediatrics, etc. According to the *Chia-i-ching* (1167, 5341, 2122), the five temperaments are *t'ai yin* (10573, 13224), *shao yin* (9746), *t'ai yang* (12883), *shao yang*, and intermediary; which might be translated, very feminine, less feminine, very masculine, less masculine, and intermediary. It is interesting to come across such a distinction based primarily upon sex, but extending to every structure and function. The following section dealing with forensic medicine is naturally derived from the *Hsi-yüan lu* (4146, 13729, 7386) of SUNG TZ'U (10462, 12406). This part is completed by two final chapters on hospitals and on the medical profession.

An atlas of Chinese anatomy fills 43 p. (p. 113-56). It contains a great number of figures extracted from Chinese and Japanese books (the source is not always indicated with sufficient care). One of these figures is here reproduced to represent the *san chiao* (fig. 1). Thanks to the courtesy of Mr. WILLIAM HUNG, professor in Yenching University, I am able to publish also (fig. 2) a drawing of the *chiao* extracted from the *San ts'ai hui t'u* (9552, 11496, 5184, 12128), the collected diagrams of the three powers (i.e., heaven, earth, and man) by WANG CH'I (12493, 1011) and his son WANG SSU-I (12493, 10271, 5454), printed in 1609. (HÜBOTTER's book contains a schema of the same drawing on p. 125).

三焦圖
此經本有名有形其經絡起于手第四指之間
動而止于面部之耳後絲竹空其府附于右腎
後世以為有名無狀者非其禍始于秦越人而
右腎
左腎
三焦總司
有名有形
有經絡
有名有形
脂膜繫府
有經絡
仍于王叔和北其原見于右手尺部與手厥陰
心包絡經為表裏系問靈蘭秘典論云三焦
者決瀆之官水道出焉

FIG. 2

Some 15 p. are devoted to illustrations relative to acupuncture. The most interesting of these is one representing a bronze model kept in the Imperial Museum of Tokyo (p. 145), but unfortunately no information is given about it.

This is followed by a long section on diagnosis. According to the *Huang-Ti Nei ching* (5124, 10942, 8177, 2122), the four methods of examination, *ssu chên* (10291, 605) are ; 1. wang (12509), to gaze at; 2. wên (12651), to hear or smell; 3. wên (12650), to ask (questions); 4. ch'ieh (1552), to feel (the pulse). The Chinese developed the pulse diagnosis considerably, but strangely enough paid hardly any attention to urine. Their overelaborated sphygmology formed the central part of their diagnosis. They distinguished 27 kinds of pulse (the Greeks distinguished at most 15). According to the author's excellent method, this extraordinary theory is explained by means of long extracts from two original treatises : the *Pin-hu-mai-hsüeh* (9251, 4951, 7615, 4839) of LI SHIH-CHÊN (6884, 9921, 599), of the year 1564; and a modern Japanese book by ASADA, 1918-19.

This part is completed by the translations of two very long Chinese texts.

(1) The Difficult book, *Nan-ching* (8135, 2122) a treatise in 81 chapters, ascribed to PIEN CH'IAO (9172, 1388). As I was able to announce it in my *Introduction* (vol. 1, 103), that translation was already completed many years ago; it is pleasant finally to have it. It covers p. 195 to 238. By the way the note devoted to PIEN CH'IAO in my *Introduction* ought to have been placed in the sixth century B.C., for according to SSU-MA CH'IEN (10250, 7576, 1711), he must have flourished about 531-26. That famous Chinese doctor was thus, as far as we know, a century earlier than our HIPPOCRATES, but one could not find a greater contrast than the one between the fanciful and excessive rationalization of the Chinese physician and the genial common sense of the Greek.

(2) The Secrets of pulse, *Mai-chüeh* (7615, 3225), composed by one KAO YANG (5927, 12883), presumably after the eleventh century, together with the commentary by CHANG SHIH-HSIEN (416, 9969, 4513), as edited by HSÜ ANG (4748, 75) in 1510. The *Mai-chüeh* was formerly ascribed to WANG SHU-HO (12493, 10039, 3945), who flourished under the Western Chin (265-317), and wrote a famous treatise on the pulse *Mo-ching* (8011, 2122). This ascription may be found for instance in my *Introduction* (vol. 1, 342). A complete discussion of this question would be exceedingly difficult; the author has hardly attempted it. The *Mo-ching* is divided into ten books; according to HÜBOTTER's translation (p. 239-72) the *Mai-chüeh* contains four books.

The pharmacology is treated very briefly (274-99), but this does not

matter so much because the earlier western works on Chinese medicine were largely restricted to pharmacology and botany. However a complete study of the subject is still necessary. We badly need a critical bibliography of the immense *pên ts'ao* (8846, 11634) literature, together with a study of the medical and botanical changes from edition to edition. This would be a gigantic task, but we shall not be able to understand the development of Chinese medicine until it is accomplished. To measure its size, it will suffice to recall that in his *Botanicon Sinicum*, EMILE VASILIEVICH BRETSCHNEIDER enumerated no less than 1148 Chinese works on the subject! The author has made no attempt to cover it; he simply gives a list of some 400 medicinal plants or drugs, quoting the Chinese and Latin names of each. He made use of a few modern sources which are worth mentioning here.

T. MAKINO and K. NEMOTO: *Catalogue of Japanese plants in the herbarium of the natural history department of the Imperial Museum* (Tokyo, 1914).

JINZO MATSUMURA: *Shokubutsu mei-i* (second edition, Maruzen, 1921).

Chih-wu-hsüeh-ta-tz'u-tien (1849, 12777, 4839, 10470, 12402, 11177), a large dictionary of botany (1700 p., Commercial Press, Shanghai, 1917).

The list of plants is followed by a brief note on weights and measures, by a collection of the most usual recipes (p. 301-14), and by brief accounts of massage and gymnastics. The most important feature of Chinese gymnastics, or indeed of Oriental gymnastics, is the astounding technique of breathing to which I have already alluded. This was developed by the Hindu Yogi, by the Chinese Taoists, and finally by the Zen Buddhists. The author describes briefly such exercises witnessed by himself in Kumamoto.

With regard to Chinese surgery, he remarks that it is easy to dispose of it, because there is not any! The only Chinese surgeon was apparently HUA T'O (5005, 11346), who flourished c. 190-265, and unfortunately his writings are lost. Surgery was replaced in China by a technique, which seems entirely autochthon, acupuncture. I have already referred to it apropos of the many figures illustrating it which are included in the anatomical atlas. Such figures are indeed very abundant in Chinese literature, for the same reason that bloodletting figures were relatively abundant in western writings. Acupuncture consists in pricking different parts of the body with needles, and of inserting such needles deeply into the tissues and into the organs. The best way to explain the position of the *hsüeh* (4840), i.e., of the holes which are favorable for such practice, is obviously by means of drawings. The number of *hsüeh* varies somewhat from one author to another, but is not very distant from 650. That technique is extremely involved, being regulated by all sorts of cosmic

correspondences, even as mediaeval bloodletting was, but far more so, as we would expect, knowing the relentless ingenuity of the Chinese with regard to the finding of such analogies. An amusing feature, not duplicated in western bloodletting, is the method of vicarious acupuncture : one organ may be eventually punctured instead of another, e.g., the « wife », for the « man », the « mother » for the « child » (these terms represent various organs).

Acupuncture is still practiced in China and Japan and the author had good opportunities of observing it, notably in a « needle »-clinic at Ainomura, not far from Nagasaki. The Japanese have much simplified the technique, keeping hardly more than a hundred ***hsüeh*** (4840), and dropping most of the ancient tabus. However it is still very complicated, and can hardly be learned in books. The assistants at the hospital of Ainomura must go through a period of apprenticeship lasting four years. The needles used are very fine (their diameter being only a fraction of a millimeter) and are disinfected with a solution of carbolic acid. The author witnessed the insertion of such needles deep into the lungs or into the viscera without unpleasant consequences.

A final chapter (p. 340-55) contains a historical sketch of Chinese medicine. It includes a brief section on Buddhist influences.

My analysis, however short, is sufficient to illustrate the richness of this work, yet it is not at all a history of Chinese medicine. It might have been entitled : Materials for the understanding of Chinese medicine. Its publication is exceedingly welcome, though one cannot help regretting that the author, having already waited so long, did not keep it a few more years on the stocks. With few exceptions, he has made no serious attempt to distinguish the different chronological layers of Chinese medicine. It is true this would require immense efforts, which would probably be beyond the power of any single man.

The main defect of this otherwise admirable memoir is the inconsistent transcription of Chinese words. To be sure the Chinese characters are always clearly written, and that is the essential; yet their presence does not exonerate the author. The worst result of such inconsistency is that it discourages the compilation of an index. On the other hand, it would have been relatively easy for him to unify the spelling, even at the eleventh hour, and if he had done so, it would have been possible to add the index, without which the usefulness of his book is much impaired.

GEORGE SARTON.

William Cecil Dampier-Whetham. — ***A history of science and its relations with philosophy and religion.*** XXI + 514 p., 14 fig. Cambridge, University Press, 1929 (18 s.)

One of the first books to reach me soon after the creation of *Isis* was « Science and the human mind » written by WILLIAM CECIL DAMPIER WHETHAM (1) and CATHERINE DURNING WHETHAM, his wife (London, 1912). It was a very stimulating book to which a long review was devoted (*Isis*, 1, 125-32). The same authors published a very interesting paper entitled « Three English men of science », in the first volume of *Isis* (215-18, 1913). When I heard that one of them had published a new history of science, I was thus very curious to see it. WHETHAM's development as historian of science has been exactly contemporaneous with mine, but while I have consecrated myself almost exclusively to these studies, his attention has been divided between them and many others. In my review of *Science and the human mind* I gave a list of his many publications on eugenics and I fully discussed his anthropological interpretation of the development of science. I shall not come back to that, but the following titles will give the reader a good idea of the author's manifold activities: Recent development of physical science (five editions from 1904 to 1924). Article Science in the eleventh edition of the Encyclopaedia Britannica (1911). Cambridge readings in the literature of science, arranged with his daughter MARGARET (1924, 1929). The war and the nation, a study in constructive politics (1917). Matter and change (1924). Politics and the land (1927).

To return to the volume under review, though it is far more elaborate than *Science and the human mind*, it is still a sketch, cannot be more than a sketch, and in all fairness to the author must be judged as such. To tell the whole history of science in one volume is an extremely difficult, if not impossible, achievement. The author who succeeds in avoiding the Charybdis of a dry catalogue of names risks wrecking himself upon the Scylla of an unconvincing arbitrariness. The reader will appreciate better what such condensation implies, if he compares it with other feats more familiar : just think of what it would mean to write in a single volume of moderate size the whole history of art (of all the arts) or the whole history of literature (of all the literatures). However these two feats would be considerably easier, for we have so many histories of art and of literature, histories of all kinds, pedigreed histories we might call them, because each is the result of a long selection, so that the difficulties would be chiefly literary ones. Most of the facts involved are relatively well known and classified, and while the condensation would still be very difficult, the preliminary choice of facts would be simpler. For the history of science, these pedigreed textbooks do not yet exist

(1) The author's surname has apparently changed in the meanwhile from Whetham to Dampier-Whetham.

—except to some extent for mathematics and medicine—and thus the writer of a book like this one is necessarily a reckless adventurer. The simplest outlines of a subject can only be written well when elaborate accounts are already available; a good primer must not be written first but last.

All of which is said in advance to explain the author's shortcomings. His work, however interesting (especially on the physical side), is very imperfect—but this was clearly unavoidable. To judge him fairly we must bear in mind the insuperable difficulties of the task to which he had addressed himself. Call him a dilettante or a reckless adventurer if you please, yet be thankful to him for the effort he has made. No scientist should read this book without caution, but none will read it without profit.

The most striking feature of it is the fact that more than half is devoted to the nineteenth century and after. There is much to be said for this subdivision, unequal as it may seem to the historian. The author obviously is writing not for historians interested in science, but for physicists with a historical bent, and as I remarked apropos of GARRISON's history of medicine (*Isis*, 13, 138), it is probably this kind of subdivision which will satisfy the needs of men of science best. Another striking fact is the predominance of physics. This is not surprizing considering the author's training, but in spite of the real importance of physics, it gives one an impression of lopsidedness. It is a pity that the author did not obtain the assistance of a biologist, for the biological parts of his book are utterly and shockingly insufficient. They are insufficient both in the selection of items and in their treatment. Consider, e.g., the subdivisions of chapter VI, Nineteenth century Biology : « The significance of biology—Organic chemistry—Physiology—Microbes and bacteriology —The carbon and nitrogen cycles—Physical geography and scientific exploration—Geology—Natural history—Evolution before Darwin—Darwin—The fight for evolution—Anthropology » (all of which in 40 p.).

Yet in spite of its shortcomings, which are many, some of which excusable, others not, WHETHAM's book is very stimulating and thought-provoking. It is to be hoped that many students will read and discuss it, but that they won't swallow it whole ! GEORGE SARTON.

Frederick Barry. — *The scientific habit of thought.* An informal discussion of the source and character of dependable knowledge. XIII + 358 p. New York, Columbia University Press, 1927 ($ 3.50).

The history of science is so vast a subject that we must expect it to be understood in many different ways. It would be foolish to say that this or that point of view is the only good one, or the best one; these

different points of views are not conflicting, but on the contrary supplementary. If *Isis* may seem to be laying undue emphasis on erudition, it is simply because we hold that here as elsewhere, whichever the point of view, it is essential that the facts be right. We do not object in the least to the philosophical point of view in itself, but only to the combination of philosophical earnestness with historical levity; we do not object to rationalization, but to premature rationalization.

The first task obviously must be to ascertain the facts, but it would be foolish to suspend our judgments until all the facts were known and well known, because this would postpone our judgments indefinitely, and reduce us finally to intellectual impotence. Historical analysis and philosophical synthesis must go on hand in hand. The publication of such a book as BARRY's is thus welcome, and it is especially welcome, because of its excellence in almost every respect.

The author is that sort of *rara avis* combining a long and deep familiarity with experimental science with a sound philosophical and mathematical training. He has taken pains to ascertain the main facts of the history of science and to understand their implications, and long discussions on the subject with students and colleagues have taught him to express his views with great clarity, elegance, and humor, without dogmatism. Hence he is very persuasive without being tyrannical.

The whole book is divided in only four chapters: 1. Science and sciences. Discussing the meaning of science, and the main epistemological problems; 2. The nature of fact; 3. The elements of theory; 4. Scientific humanism.

Our criticisms might be reduced to three. First, considering the very richness of this book a subdivision into a greater number of chapters would have been useful, especially for the younger readers. Second, the book would have been more valuable if it had contained more concrete illustrations, which it would have been easy enough for the author to provide. Take a statement like this (p. 193): « It frequently happens that generalizations which are inferior in a logical sense are more instructive scientifically; sometimes because they are more inclusive, sometimes merely because they are more simple. This is true also, among strictly logical coördinations; the rough simple approximation, if it will serve a given purpose, is always used in preference to its more precise elaboration. It is the problem which determines scientific preference in logic; not vice versa. » This is very neatly put but the average reader would expect some examples, and he is not convinced without them. Third, the very gentleness of the author sometimes weakens his argument. Most readers prefer to be treated with less consideration of their own scruples; the very quality, which increases the depth and the elegance

of this book, undermines its strength. It will be noticed at once that these criticisms are relatively weak, and the reviewer could not press the third one without inconsistency.

To illustrate the complexity of the argument, it will suffice to say that the third chapter includes brilliant sketches of the progressive arithmetization of mathematics, of the history of dynamics, etc. To give a better idea of BARRY's work, as a summary of it is obviously out of the question, the best method is perhaps to quote a few extracts.

(p. 194) « Scientific knowledge, determined by successive discoveries of facts, constructs its theory as it goes. Its logic, therefore, is always retrospective. »

(p. 10) « The accumulated results of toughminded labor are science, certainly; but the labor itself is also science. To the onlooker, science is knowledge; to the worker, it is activity. Seen from the outside, it is the process of acquisition. The world at large is interested in the results alone, but the participator is interested also in the procedures. To borrow the imagery of our fellow-sportsman — the spectators see the game, but the players live it; the spectators know about the game, but the players *are* the game. »

(p. 78) « There is no unavoidable conflict between religion, thus conceived, and science; no serious issues which arise from temperamental antagonism alone. The great conflicts of the past have always been, as those of the future will probably always be, the conflicts between fixed and unreconcilable beliefs; and never between beliefs concerning a transcendent mystery, excepting when these have become entangled with contradictory opinions concerning our actual world. These opinions themselves, more frequently than not, have been advanced as the justification of more primitive motives — the fear of change in custom, blind loyalty to ancient institutions, the lust of power either petty or grandiose; and the bitterest of all this warfare has been waged in the defence of individual freedom against aggressions thus incited. They have been battles of will, primarily; instigated by fear, desire, ambition, or greed, supported when they have not been provoked by the power of group obsessions, and never directed by intellectual or religious purposes excepting when thought has been enslaved by the strong emotion which is generated by these primitive impulses. To call such warfare the conflict of science and religion is essentially to misrepresent it : it is rather the warfare between humane intelligence and the brute will to dominate and command, excited or sustained by group prepossessions. Its issue is not between religion and science, but between oppression and toleration. »

There is much more that we would be tempted to quote, e.g., on

science's debt to speculative philosophy (p. 68), on the validity of science (p. 24); on science vs. logic (p. 189); on « magic » in mathematics (p. 214), on the place of science in education (p. 280), but we must let the reader find these nuggets himself, these and many others.

GEORGE SARTON.

David Eugene Smith. — *A source book in mathematics.* XVII + 701 p., 9 pl., figs. New York, McGRAW-HILL, 1929. ($ 5).

It is very fortunate that this volume follows so closely upon the heels of the first one (on astronomy, see *Isis*, 13, 130-34) and may thus destroy the bad impression created by the latter and restore confidence in the undertaking. Indeed it is as good as the other volume was slipshod. In spite of the fact that the main author was also mathematical editor of the new Britannica, he did his work very well. It must be added that he was helped by an excellent group of advisers (ARCHIBALD, CAJORI, DICKSON) and by devoted assistants, above all, LAO G. SIMONS, JEKUTHIEL GINSBURG, VERA SANFORD, HELEN M. WALKER.

To have a general idea of the comprehensiveness of this survey, let us find out how the various nationalities are represented. Let us count the extracts relative to each. The number of mathematicians is a little different, because some extracts deal with more than one author, and some authors are represented by more than one extract; these authors however are the most important (PASCAL, NEWTON, EULER, GAUSS, etc.) and thus counting the extracts is somewhat like counting the authors but giving different « weights » to them. France is represented by 26 extracts; Germany, by 25; England, by 20; Italy, by 9; Switzerland, by 6; Scandinavia, by 5; Russia, by 3; the Netherlands and Hungary, each by 1. This distribution seems fair : the leading nations being France and Germany, with England following closely. The most striking fact is the absence of American contributions, in great contrast with the astronomical volume, wherein the United States ranked third out of nine nations, two ranks ahead of France !

The extracts are preceded by short bio-bibliographical introductions which are generally well done, but very unequal. This inequality is obviously due to the diversity of collaborators; the editor might have been a little more vigilant in this respect. Reading a few of these biographies, at random, I cannot help grumbling a little. The information given on JAMES I BERNOULLI is very scanty; we are not even told where he was born; more information is given on two other mathematicians, JOHANN FAULHABER and NICHOLAS MERCATOR, mentioned in the same extract, than on the author himself ! There is a long introductory note on ROLLE's theorem, but nothing is said about ROLLE himself.

I do not think that very much ought to be said; two or three lines would be sufficient, but these lines are missing. Apropos of DE MOIVRE's Law of normal probability, it would have been worthwhile to say that a facsimile of his first paper, the *Approximatio* of 1733, was published in *Isis* (vol. 8, 671-83, 1926). The note on SYLVESTER covers ten lines, it begins: «SYLVESTER was barred from certain honors in England because he was a Jew». True enough, but was that the outstanding fact of his life, or the first to deal with?

The average length of the extracts is a little above 7 p.; and the most frequent length seems to hover about that figure. By far the longest extract is SOPHUS LIE's memoir on a class of geometric transformations (40 p., 1871); I have no strong objection to this, but the second extract in point of length is, curiously enough HORNER's method (21 p., 1819), and is this not extravagant?

I have already deplored the stupid policy of this series not to consider sources anterior to the advent of printing. This cannot be accounted for except by the scientific ignorance of the general editor. In the case of mathematics this policy was peculiarly deplorable, for it removed a large amount of materials of immense significance. It is true that the loss sustained by the general reader is to some extent a gain for the mathematician, who has thus been given more documents of vital interest. The fact is that this source book will be of little value except to mathematicians, whereas one giving some space to the earlier history would have appealed to a much larger audience.

After all for which kind of readers are there source books compiled? I would have assumed they were compiled for the elite of the educated public, but not for the very experts. For example, a mathematician curious of the past reads a history of mathematics and then tries to obtain the old books which interest him most. He will hardly depend on extracts for the chances are that these do not contain the very things he is looking for. On the other hand the philosopher, who is not a mathematician, will not be able to do much with this volume, while one devoted to the earlier period would have proved very stimulating. One could not lay too much stress on the fact that the purpose and methods, the very spirit of mathematics, can be illustrated just as well by means of the simpler mathematical concepts, as by means of the more complex and esoteric. However these source books will be very useful for teachers of the history of mathematics (or other sciences) and their classes.

According to D. E. SMITH's old preference, this volume is divided not in strict chronological order, but in five «fields», viz.: number; algebra; geometry; probability; calculus, functions, quaternions. It is hardly worthwhile to quarrel about that subdivision and the choice of

extracts, about which no two mathematicians would agree anyhow. I shall make only two remarks. The setting apart of probability (59 p.) is an excellent idea; incidentally it is a good symbol of the statistical preoccupation of our age. On the other hand the last section is far too short, a defect which cannot be cleansed by the editor's lame apology. It covers not more than 92 p. For the sake of illustration, it includes extracts from the following authors: CAVALIERI, FERMAT, NEWTON, LEIBNIZ, BERKELEY, CAUCHY, EULER, JOHN I BERNOULLI, ABEL, BESSEL, MÖBIUS, HAMILTON, GRASSMANN. No space is given to infinitesimal geometry, to the theory of surfaces. It would have been tempting to select such a fine piece as DUPIN's theorem.

Geometry is represented by the following: DESARGUES, PONCELET, PEAUCELLIER, PASCAL, BRIANCHON, FEUERBACH, WILLIAM JONES (first use of the symbol pi for the circle ratio), GAUSS, SACCHERI, LOBACHEVSKY, BOLYAI, FERMAT, DESCARTES, POHLKE, RIEMANN; MONGE, REGIOMONTANUS, PITISCUS, DE MOIVRE, CLAVIUS, STEINER, CREMONA, LIE, MÖBIUS, CAYLEY, SYLVESTER, CLIFFORD. Note that the order is not even chronological within a certain field. Thus a reader who would like to have some idea of the broad chronological development of mathematics would find this book very awkward to use. I shall not criticize SMITH's method too much, because I am aware of its advantages, but why did he not at least try to remedy its very obvious disadvantage? This could have been done very easily, by adding a table of the extracts, or of the mathematicians, in chronological order. To return to the geometrical selection, I shall simply remark that STEINER was permitted to say only five lines, and VON STAUDT was not allowed to say anything! To be sure their works are highly technical, but not more so than many others from which long quotations are made.

I do not mention these gaps by way of criticism of the author. Any selection would be insufficient in many respects. This illustrates the general weakness of anthologies and their little value from a scholarly point of view. The briefest history covers in its way the whole field; the best and longest anthology never does.

Taking these necessary limitations into account, this source book is a very good and useful work. Some of the little defects above mentioned could be easily corrected in a new edition. GEORGE SARTON.

Ernst Honigmann. — *Die sieben Klimata und die πόλεις ἐπίσημοι.* Eine Untersuchung zur Geschichte der Geographie und Astrologie im Altertum und Mittelalter. 247 p., 4 fig. Heidelberg, WINTER, 1929 (Mk. 25).

This is a very important contribution to the history of ancient and

mediaeval geography, partly based on manuscript documents in Greek, Latin, Syriac, Hebrew and Arabic. A contribution also to the study of astrology, for geography and astrology became curiously mixed up about the second century B. C., and remained interrelated until the end of the middle ages.

The central theme is the birth and evolution of the concept of clima, which is here fully explained for the first time. J. W. KUBITSCHEK's article on the subject in PAULY-WISSOWA (vol. 11, 838-44, 1921; *Isis*, 6, 196) was inadequate. The original idea of clima (literally, an inclination) was that of a landzone the parts of which are equally inclined to the sun rays. It will be noticed at once that the idea was the adumbration of the more definite notion of latitude. It implied a belief in the spherical shape of the earth. It is impossible to say exactly where it originated, but ERATOSTHENES was probably responsible for its first scientific formulation. Later it was extended to celestial as well as to terrestrial zones, and varied considerably, its variations oscillating between its scientific limit, latitude, on the one hand, and the vaguer meaning of region on the other. In the Byzantine age, the word clima was finally used to designate a government district or a diocese. For a scientific interpretation of the clima, as a zone, we had to wait until the isothermic lines had been defined by ALEXANDER VON HUMBOLDT in 1817.

To return to the original idea, at some time or other between the second half of the third century B. C. and the first half of the first century B. C., it became generally understood that there were seven climata. Why seven? was this due to oriental influence, — or was it simply that the first scientist who developed the idea of clima, probably ERATOSTHENES, considered the climata as being at such distance from one another that the length of the longest day in each differred by half an hour from that of its closest neighbours? Now the southernmost clima was that of Meroë, the northernmost that of the mouth of the Borysthenes (Dnieper); the lengths of the longest days in each were respectively 13 and 16 hours. On that basis there was room for seven climata and no more.

We shall not follow the author in his long discussion of the Greek origin. HIPPARCH is at once excluded because he avoided the idea of clima, and even the term, as unscientific, trying to replace it by the more definite idea of latitude. POSIDONIOS was not the originator, but rather a reformer. ERATOSTHENES was probably the true inventor, but if so, the climata were not conceived by him as contiguous zones, nor yet as lines, but as a series of what we might call average latitudes.

At some time in the second or first century B. C. there developed the notion of seven contiguous zones, and this development took apparently

place under astrological influence to be able to place each locality in this or that clima; of course this was impossible as long as the climata were understood in the Eratosthenian sense; it was necessary that they should fill up the whole oikumene. This development may be ascribed to POSIDONIOS, or more probably to SERAPION OF ANTIOCH. The works of this SERAPION were read by P. NIGIDIUS FIGULUS, CICERO, MANILIUS, and PLINY, and thus influenced, directly or indirectly, all the later astrologers. He may have been one of HIPPARCH's pupils, but if so, it is likely that he was somewhat older than POSIDONIOS, not younger as the author says (p. 30). The oldest treatise of astrological geography and ethnography may be traced back to him. In that lost treatise all the facts concerning peoples, countries, planets, and zodiacal signs were brought together and classified according to the climata. He constructed a map of the world whereon the climata and the « remarkable cities » (*πόλεις ἐπίσημοι*) were indicated. Finally he compiled astronomical tables (*πρόχειροι κανόνες*), which served as models for PTOLEMY and indirectly, for a whole series of Arabic astronomers.

This stage in the evolution of climata is well represented by PLINY's Natural history. An analysis of PLINY's *circuli* will be found on p. 33-39. PTOLEMY never used the term clima in his geography, but we find in the Almagest seven tables relative to the parallels of Meroë, Syene, etc. The parallels are called *παράλληλοι* but the tables are spoken of as *ἔκθεσις καθ' ἕκαστον κλίμα*. Another treatise of his, the *Φάσεις ἀπλανῶν ἀστέρων*, composed in 137-38, is also arranged according to the climata.

The « remarkable cities » of which SERAPION had already drawn a list, which is more or less faithfully reproduced by PLINY, are also enumerated in that famous Byzantine chronicle, the *Chronicon Paschale*. That chronicle, composed c. 629-41 (my *Introduction*, vol. 1, 482), was largely derived from older sources. The tables of climata and of the remarkable cities of each were borrowed from SEX. JULIUS AFRICANUS, or more probably from HIPPOLYTOS. An examination of their text (on p. 82-87) shows that they were made far more carefully than the Plinian tables (p. 33-39). Similar data are also found, but differently arranged, in PAPPOS, THEON OF ALEXANDRIA, and in a lost text of Justinian's age, the *Praeceptum canonis Ptolemei* which seems to have been used considerably in the Latin West.

All this may be said to represent the ancient tradition of climata. A curious novelty is offered to us in the Christian topography of COSMAS INDICOPLEUSTES. COSMAS was especially anxious to refute the pagan theory of the sphericity of the earth; he claimed that if the earth were spherical a part of the oikumene would always remain in the darkness. Yet by his time the idea of climata, implying that sphericity, was too

κατα την θερινην τροπην ο ηλιος διατρεχων παυνι κε ωρα c. της ημερας:

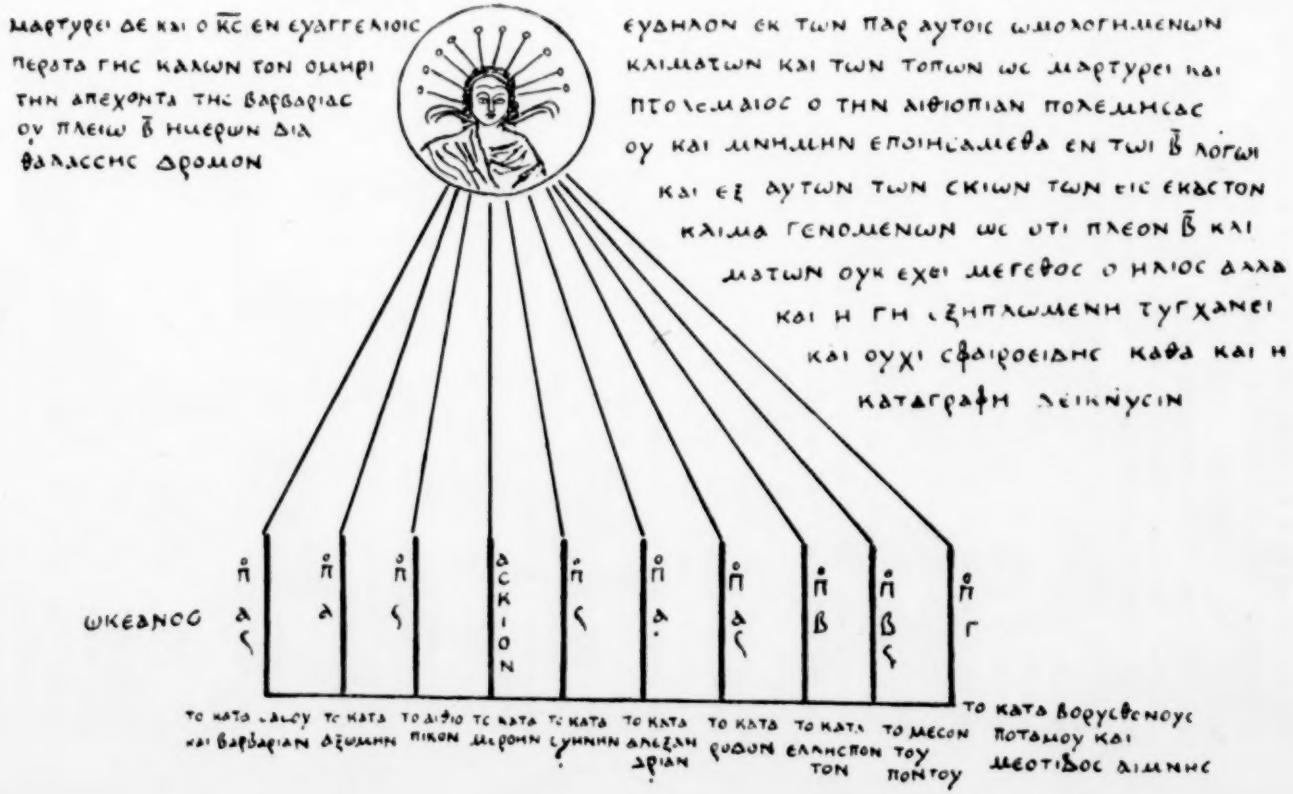

μαρτυρει δε και ο κς εν ευαγγελιοις
περατα γης καλων τον ομηρι
την απεχοντα της βαρβαριας
ου πλειω β ημερων δια
θαλασσης δρομον
ευδηλον εκ των παρ αυτοις ωμολογημενων
καιματων και των τοπων ως μαρτυρει και
πτολεμαιος ο την αιθιοπιαν πολεμησας
ου και μνημην εποιησαμεθα εν τωι β λογωι
και εξ αυτων των σκιων των εις εκαστον
καιμα γενομενων ως οτι πλεον β και
ματων ουκ εχει μεγεθος ο ηλιος αλλα
και η γη εξηπλωμενη τυγχανει
και ουχι σφαιροειδης καθα και η
καταγραφη δεικνυσιν
ωκεανος
σκιον
το κατα αιθιοπιαν και βαρβαριαν
το κατα μερον
το κατα συηνην
το κατα αλεξανδρειαν
το κατα ροδον
το κατα ελλησπον
το μεσον του ποντου
το κατα βορυσθενους ποταμου και μεοτιδος λιμνης

Fig. 1

well established to be dropped. Indeed it dominated the whole teaching of geography and astrology. What would COSMAS do? He simply applied it to his own conception of the shape of the earth. This is well illustrated in the miniatures of the main Mss. Thanks to the author's courtesy I am able to reproduce his schema of these miniatures (fig. 1). The horizontal line represents the earth, the ten verticals represent climata, — the seven on the right being the ancient ones, the three on the left the new southerly ones discovered by COSMAS. The drawing refers to the time when the sun is immediately above Meroë; the sun being assumed to be very small and very near, the inclination of its rays varies considerably with the climata, as shown on the diagram.

Another example of Byzantine decadence is exhibited in a sixteenth century Ms., the Parisinus Gr. 1707 (edited in appendix 4, p. 228-29). To the clima of the Hellespont has been added that of Byzantium, not near it though, but at the end of the seventh one! It is clear enough that the author did not understand what he was writing.

There is no point in following the Byzantine tradition any further. Let us now consider rapidly the oriental traditions, Syriac, Arabic, and Hebrew.

Fortunately the Syriac tradition began very early, and was thus entirely independent of the Byzantine deformations. The earliest author, BARDESANES (second half of the second century), took pains to justify the theory of climata in the eyes of Christians by showing that it was not necessarily connected with pagan astrology. The Syriac tradition was continued by SEVERUS SEBOKHT, JACOB OF EDESSA, and GEORGE, bishop of the Arabs. I shall not analyze it, because it remained relatively unimportant until a later time when it was but an indirect reflection of Arabic science.

The main Syriac contribution was to prepare the Arabic revival. Through Syriac and other channels, the Muslims obtained communication of the main results of Greek geography and astrology, that is, essentially, the text and maps of PTOLEMY's geography, the Tetrabiblos and THEON's elaboration of the list of remarkable cities. The transmission of the *πρόχειροι κανόνες* and especially of the *κανόνες πόλεων ἐπισήμων* is particularly interesting, for the Arabic zîjât (plural of zîj, astronomical table) were essentially derived from them. The Zîj Baṭlamyûs (i.e., PTOLEMY's table) and the Kitâb al qânûn of Baṭlamyûs (PTOLEMY's canon) were free versions of THEON's manual tables. This part of HONIGMANN's memoir is of such interest for the study of Greco-Arabic science in general, that I beg leave to quote his conclusions verbatim (p. 155):

« 1. Die ma'mûnische Karte war die graphische Darstellung der Aufzählung

von ' Namen der bekannten Länder und Städte, die jedes Klima besitzt ', eines Abschnittes in dem Tafelwerke az-zîj al-Ma'mûnî al-mumtaḥan, der innerhalb von ihm die gleiche Stelle einnahm, wie die κανόνες πόλεων ἐπισήμων innerhalb der πρόχειροι κανόνες. In diesem Abschnitte waren jedoch — wie möglicherweise in einer arabischen THEON Bearbeitung — die antiken Ortsnamen vollständig durch arabische ersetzt und nur die Grenzen der Oikumene und der Klimata beibehalten; die Längengrade wurden vermutlich noch nach persischem Muster von Osten her gerechnet, was der erhöhten Bedeutung des Orients, verbunden mit einer gewissen Reaktion gegen die westliche ' Orientierung ' der Wissenschaften, entsprach, und woran man wohl auch wegen des linksläufigen Duktus der arabischen Schrift zunächst noch festhielt, zumal es für sie die logische Konsequenz aus PTOLEMAIOS' Anweisung (Geogr. II, 1, 4), die das εὔχρηστον des Vorschreitens in der Schreibrichtung auseinandersetzt, darstellt. Wir sehen also, dass in der ' astronomischen Geographie ' die arabische Karte noch am reinsten erhalten ist.

2. Eine geographische Schrift, die in ähnlicher Weise wie AL-KHUWÂRIZMÎS Ṣûrat al-arḍ aus ptolemäischen und arabischen Bestandteilen zusammengesetzt war, das Kitâb al-malḥama, ist wahrscheinlich identisch mit der für AL-KINDÎ angefertigten ' schlechten ' PTOLEMAIOS Übersetzung. Sein zeitliches Verhältnis zu AL-KHUWÂRIZMÎ vermochten wir nicht sicher zu ermitteln; jedenfalls scheinen beide Werke völlig unabhängig voneinander entstanden zu sein. Das Buch enthält z. T. genauere ptolemäische Positionen als AL-KHUWÂRIZMÎ.

3. Das Kitâb ṣûrat al-arḍ des AL-KHUWÂRIZMÎ ist wohl als ein Versuch anzusehen, die ma'mûnische Karte mit einer ptolemäischen Erdkarte zu einem möglichst einheitlichen Bilde zu vereinen; ein Versuch, der freilich nur sehr unvollkommen gelungen ist.

4. Eine ziemlich genaue Übersetzung der ptolemäischen Geographie scheint später THÂBIT IBN QURRA hergestellt zu haben. Aus ihr wollte NALLINO die Positionen des AL-BATTÂNÎ ableiten; wir sahen jedoch, dass gewisse Bedenken gegen seine Ansicht bestehen. Bewahrheitet sich die oben vertretene Auffassung, nach der das von AL-BATTÂNÎ zitierte Kitâb ṣûrat al-arḍ früher anzusetzen wäre als die ma'mûnischen ' erprobten Tafeln ', so müssen wir die Existenz einer vorma'mûnischen PTOLEMAIOS Bearbeitung annehmen. Die ma'mûnischen Tafeln selbst wären dann als ein Produkt der Reaktion gegen die Bevorzugung der griechischen Wissenschaft anzusehen; sie enthielten anscheinend fast gar keine antiken Namen und die wenigen nichtarabischen Toponymen in ihnen gingen offenbar auf eine syrische Quelle zurück.

Während die ma'mûnischen Tafeln in ihrer Anlage einigermassen den πρόχειροι κανόνες THEONS entsprochen haben, sind die drei letztgenannten Werke vielmehr von der Geographie des PTOLEMAIOS abhängig, aber — wenigstens in den ersten beiden Fällen — anscheinend nicht von dem Originalwerk, sondern von einer (vorarabischen?) Umarbeitung, die bereits eine stark veränderte Stoffverteilung und -auswahl aufgewiesen haben muss. Wie wir oben sahen, waren die PTOLEMAIOS Bearbeitungen den Arabern unter dem Namen Kitâb jighrâfiyâ (oder übersetzt K. ṣûrat al-arḍ) des Baṭlamyûs bekannt. »

See also (on p. 126-31) the list of 64 cities with their coordinates according to PTOLEMY, AL-KHWÂRIZMÎ, AL-BATTÂNÎ, and YÂQÛT, and (on p. 144-51) another list of 157 cities with their coordinates according to AL-KHWÂRIZMÎ and AL-BATTÂNÎ. According to AL-MAS'ÛDÎ, PTOLEMY's

geography contained the description of 4530 (530?) cities, more than 200 mountains, the five seas and their islands, the 230 great springs, the 290 perennial rivers of the seven climates.

The reader should bear in mind that outside of the two Greco-Arabic geographical traditions mentioned at the end of the German quotation, there was also a purely Arabic tradition represented by the topographical descriptions (Kitâb al-masâlik wal-mamâlik) which were compiled for administrative purposes, and furthermore that the Greco-Arabic traditions themselves were considerably enriched by the activity of Muslim travelers and geographers.

To return to the climata the reader will find on p. 163 a comparative list of them according to AL-FARGHÂNÎ, AL-BATTÂNÎ, AL-BÎRÛNÎ, AL-SHÎRÂZÎ, and AL-JAGHMÎNÎ, and on p. 180, according to AL-DIMASHQÎ, finally on p. 184, according to the Hebrew treatise Ẓurat ha-erez of ABRAHAM BAR ḤÎYÂ, and on p. 189, according to the *Liber de astrolabio* of HERMANN OF REICHENAU.

The latter (HERMANNUS CONTRACTUS, second half of the eleventh century) is the only Latin writer, to whom special attention is paid and HONIGMANN's long survey ends with an analysis of his *De astrolabio*. The theory of climata was continued by Latin writers, new climata being occasionally added to the seven ancient ones, after the example of PLINY, MARTIANUS CAPELLA, and COSMAS INDICOPLEUSTES. For example, in his *Cosmographia* (1524), PETER APIAN (d. 1552) added an eighth clima dia Riphaeon and a ninth, dia Danias; others were added in the southern hemisphere (e.g., anti dia Meroës), but these additions did not affect the theory itself which long survived its usefulness in the geographical textbooks.

A number of Greek texts relative to the climata and the « remarkable cities » are edited in the appendix (p. 193-231), and there are abundant indices.

The only defect of this very learned memoir is that it is not well composed, and that digressive explanations make it sometimes difficult to follow the trend of the author's argument. It could not be translated into English without being entirely re-digested and re-written.

The cosmographer AL-DIMASHQÎ (quoted on p. 180) died in 1326-27, not in 1256-57. GEORGE SARTON.